ESSAY ON THE

PATHOLOGY OF THE BLOOD.

ESSAY ON THE

PATHOLOGY OF THE BLOOD.

ESSAY

PATHOLOGY OF THE BLOOD

CONTAINING VESSELS.

BY

THOMAS A. WISE, M.D.

F.R.S.E., F.R.C.P.E.

LATE HON. EAST INDIA COMPANY'S MEDICAL SERVICE.

"Observez que la science medicale et physiologique n'a des fondemens réels dans ses explications, que depuis qu'on a analysé les lois vitales, et qu'on les a montrées comme etant partout les principes des phenomenes."—BRECHAT, *Anat. Gen.* t. ii. p. 313.

EDINBURGH:

ADAM AND CHARLES BLACK.

MDCCCLVIII.

/51. α . 2/2 .

PREFACE TO THE FIRST EDITION.

———◆———

THE author commenced the inquiries recorded in the following pages under the belief that important additions to medical knowledge are not to be made so much by ingenious theories, or novel speculations, as by the modest and slow, but certain, method of observation and induction. He had no favourite doctrines to maintain, no prejudices to gratify. His only desire was faithfully to record the facts which he saw, and what appeared to him the legitimate inferences from these facts. The result is certainly different from his expectations. By following the progress of many cases of phlebitis, by applying the test of experiment, and by carefully examining the records of medicine, he has arrived at conclusions different from the views generally entertained. With the diffidence which the consciousness of peculiar opinions should create, yet, with a confidence which demonstration alone can justify, he has from time to time made known through the press such facts as appeared to him to be established. These he has been induced, though with hesitation, to reproduce, in a connected and uniform shape ; and, along with them, he presents the theory which, by the force of these facts, he was unexpectedly led to form, and for which he now entreats the candid consideration of the reader.

CALCUTTA, 1834.

NOTE TO THE SECOND EDITION.

THE above sentences contain the substance of the Preface to the following Treatise as printed first in Calcutta in 1831, and afterwards in a more extended form in the Calcutta Medical Journal in 1834. While the author was still absent in India, the First Part was reprinted in London about ten years ago. To that he has now added a reprint of the Second Part, on the Diseases of Vessels, with a few of the drawings in explanation of his views.

EDINBURGH, *April* 1858.

DESCRIPTION OF THE ENGRAVING.

—◆—

Fig. 1 illustrates the course of phlebitis in the arm after venesection, and the salutary efforts of nature to stop the progress of the disease at *b*. The wound was made in the median basilic vein, which inflamed, and an abscess formed at *f*. As the disease advanced, the consolidated blood at *h* and at *c* was broken down and converted into pus: this change was seen in progress at *c*. The abscess pointed at *a*, and the patient died from the constitutional effects.

Fig. 2. Fatal case of phlebitis produced by an attempt to heal a varicose ulcer in the leg, by opening the vein, and healing the wound by granulations. See Case, page 354.

Fig. 3. Phlebitis occurring from the formation of an abscess, when the stump of an amputated limb had nearly healed. See page 342.

Fig. 4. Consolidation of blood in a vein from the irritation of a ligature. See page 335.

Figs. 5 and 6. The effects of a strong ligature applied to the femoral vein, artery, and popliteal nerve, in a man who died two days after the amputation of his leg. From the severity and continuance of the cause, the inflammation in the vein had rapidly passed on to the suppurating stage; while the artery had consolidated portions of blood at its extremity. See page 369.

Fig. 7. Example of the rupture of the descending portion of an aorta at *b*, by percussion. See page 319.

Fig. 8. Phlebolites: *a*, *c*, common forms; *b*, as frequently found, surrounded with a coagulum of blood; and *d*, one divided, shewing its laminated structure. See page 337.

CONTENTS.

PART II.

DISEASES OF VESSELS.

ARTERIES, VEINS, AND CAPILLARIES.

BOOK 1.

DISEASES OF ARTERIES.

BOOK II.

DISEASES OF VEINS.

BOOK III.

PATHOLOGY

BLOOD AND ITS CONTAINING VESSELS.

PRELIMINARY OBSERVATIONS.

THE ancient Philosophers and Physicians being in a great measure
ignorant of anatomy, and prejudiced against dissection, confined their
observations to the phenomena of the living body; and the humours
or fluid parts of the body were held by them to possess a direct
and peculiar influence on the healthy and morbid states of the sys-
tem. Such opinions appear to have been first promulgated by the
Brahmuns of Hindustan, at an uncertain, though very remote, pe-
riod of antiquity; and to have been afterwards adopted by the
Egyptian priests, and Grecian physicians. The tenets of this system
were further expounded and reduced to a more regular form of
doctrine, by Galen; and, supported as they were by his genius,
eloquence, and learning, they were for a long period generally re-
ceived in the West, having successfully withstood the feeble attacks
made against some of their imperfections, by the Arabian physi-
cians. After the restoration of learning in Europe, the same sys-
tem was incorporated with the principles of the chemical physicians,
and continued to flourish in our schools to the beginning of the
eighteenth century; it is still indeed the medical doctrine of a
large proportion of mankind.

In accordance with this theory, four elements of the world were

B

recognised :—fire, air, earth, and water, endowed with the qualities of heat, cold, dryness, and humidity. The body again was considered as a microcosm, formed of four humours,—the blood, lymph, bile, and atrabile, by which it possessed the same qualities as the elements of the world, with their corresponding temperaments ; and it was held to be tenanted by the vegetative, sensient, and rational souls, which manifested themselves through the agency of the natural, vital, and animal spirits.

In disease the morbific cause was supposed to act exclusively on the fluids ; and the symptoms being interpreted upon the theory of these humours, more attention was given to the explanation of particular phenomena, in proportion as the hypothesis assumed seemed more readily to supply a reason for such appearances :— Other circumstances in the course of disease were negected, probably from not being so easily accounted for.

The development and course of the symptoms in different diseases were also supposed to be produced by changes in the humours ; and the terms crudity, coction, and evacuation of the morbific matter, were used to express such supposed changes. In the first stage of disease the deleterious or peccant matter was not supposed to have undergone any change in the body, and was therefore called *crude ;* as nature assumed the ascendancy, *coction* took place ; and when the morbid matter was rendered mobile, it was either evacuated by the dejections, urine, prespiration, &c. or formed central deposites, by which the nature, duration, and result of the disease was judged of. In this case the balance of the system was restored, or the peccant matter in the humours was elaborated, and its character developed. When this coction was imperfect, one disease might be changed into another, by the transformation or emanation of the noxious humour.

In this system the morbid alterations of the solids were generally wholly overlooked, or considered as accidental occurrences; the names of diseases were in consequence considered according to the fluids supposed to be affected; so that a disease of the liver, peritoneum, or circulating organs, was not considered as an affection of the tissue of the organ, but as seated in the bile, the lymph, or the blood. When such explanations did not appear satisfactory, the disease was named by a collective appellation, and connected with

the theory by a subsidiary hypothesis; by which laxity of procedure, the appearances in the dead body were supposed to confirm the theory. The transfusions of the bile upon the abdominal viscera after death, for example, proved its being in excess; tubercles were coagula of lymph; organic alterations proved increased viscidity of the humours, and dropsies the dissolution of the blood.

This fanciful theory led the ancients to suppose that inflammation was produced by a stagnation of the blood in a part, the quantity conveyed thither being larger than that which is returned. Mustelanus * and Billenus † believed that such obstructions in the vessels were the only, or at least the principal, cause of inflammation.

Etmullerus, who is styled in the title-page of his works ‡ as " practius per omnem Europiam celeberrimus," gave a like explanation of the symptoms of inflammation. He supposed that the redness, heat, swelling, and pain, were either produced from the sense of distention of the fibres of the vessels and their nerves, from throbbing or rebounding of the blood when disappointed in its passage, or from the pricking, caused by the sharp salts when struggling, and tending to suppuration.§

Harvey appears to have been the first of the moderns who possessed a distinct conception of the nature of the blood's composition; for in his treatise, "De Generatione," he speaks of its coagulation or separation into fibrous and serous parts, by exposure to the air. He describes a third substance, occupying the upper part of the crassamentum, which resembles jelly, mucilage, or albumen of the egg, which he names mucilage, and supposes to be a constituent part of the blood the most abounding with spirit. The same great author discovered the property which the albumen of the blood possesses of being coagulated by heat, a fact which was more accurately stated by Lower in his Treatise on the Heart, ‖ and by Willis.¶ Some new facts were discovered by Malpighi, ** Bo-

* Opera Omnia, Genevæ, 1716.
† Fundamenta Medicinæ vera, 1685.
‡ Amsterdam edition.
§ Practice of Physic abridged and translated, London, 1703, 353.
‖ 1657, p. 6.   ¶ Op. tom. p. 72.   ** Op. De Polypis Cordis.

relli, * and Mr. Boyle ; and Leuwenhoeck, † in his letters to the secretary to the Royal Society, describes the red globules of the blood, which he had discovered by the assistance of the microscope.

The celebrated Herman Boerhaave adopted these ancient opinions; and the ability with which he enforced them explains why they were so long afterwards believed. He supposed that the cause of disease was either a thickness, a preternatural thinness, or an acrimony of an humour, which required for its cure to be diluted, thickened, or sweetened; or he held that there was an obstruction or tension to be removed, a relaxation to be fortified, an impetuosity of movement to be calmed, a plethora to be diminished, &c.

In practice he followed the principles of Hippocrates, and his theories present a plausible conciliation of all those then in vogue; more especially of the chemical and mathematical sects. The conclusions he came to from these principles of practice, are in general vague, indistinct, and often erroneous; and were peculiarly defective with respect to the vital powers of the body. His descriptions are without that circumstantial detail that is always so necessary in the relation of the course of disease, and his great work required the elaborate commentary of his pupil Van Swieten to render it intelligible.

Boerhaave attended particularly to the nature and properties of the blood; and appears to have set much store by the microscopical observations of Leuwenhoeck, who described the red globules of the blood as consisting of six serous or colourless globules, which pass through capillaries that cannot be distinguished. He explains inflammation as the effect of an obstruction of the arteries situated at the extremities of the red and commencement of the white vessels, which he calls "error loci." In this diseased state, the small vessels, which in health only convey the minute globules or colourless part of the blood are choaked up by the large red globules, which insinuate themselves into these vessels. This produces an accumulation of blood in the part, and is the immediate cause of the redness and swelling; an effort of nature to overcome the obstruction, produces the increased action in the heart, and velocity of the circulation ; while the increased sensibility and friction of the

* De Motu animal, pref. 132.   † 1673.

blood against the sides of the vessels, explains the pain and heat in the inflamed part.

The obstruction in the vessels of a part he supposed to be the effect, either of an increase in the density of the blood, or of a diminution in the diameter of the vessel. In cases of inflammation one cause only may be present, while in other cases, both causes influence the development of the symptoms.

Boerhaave supposed that resolution took place by a retrograde movement of the globules of blood in the obstructed vessels, by which they passed into larger canals, after which the symptoms of the inflammation disappeared. As the object of the physician is to obtain this salutary result, he recommended large and repeated bleedings.

It would be unnecessary to devote much space to prove the false views contained in this ingenious theory, which seems to explain the different symptoms so satisfactorily; but, when it is considered that such varieties in the blood-globules do not exist; when we see that no signs of inflammation are produced by the application of a ligature around a limb; when we discover that the laws of mathematics are inapplicable to the consideration of an organic structure; and when we find that such friction as Boerhaave supposed, cannot produce heat, and that no retrograde movements take place in the minute vessels, the whole of his theory must be considered incorrect.

The therapeutical principles of the humoral pathologists were directed to change the quantity or quality of the fluids; and as plethora and cacochymia were held the two great causes of disease, venesection was constantly employed to attenuate the consistency of the blood, to remove the morbific matter which it contained, and to enable the system to renew the healthy state of this important fluid. With a similar intent, cathartics, sudorifics, and diuretics were freely administered. Medicines, again, were frequently ordered with a view to inspissate or to attenuate the blood; and diet-drinks were administered in great quantities, in order to alter its qualities. Much reliance was placed on the powers of nature, and critical evacuations were expected with solicitude. These were principally looked for in the urine, the sweat, &c.

But the therapeutical means of the humoral school were not con-

fined to the removal of disease: they were generally had recourse
to freely for the purpose of preventing its invasion.   Periodical
bleedings and purgatives were employed to ensure the continuance
of good health; and in many countries of Asia, as well as of Eu-
rope, the poorer classes still employ these evacuants at the spring
and fall of the year for this purpose.

Besides leading to such false doctrine, the Humoral Pathology
had a most pernicious influence on the advancement of Medicine;
as it induced its followers to trust to the uncertain and imperfect
light which imagination sheds upon this difficult science, rather than
to rely on the slow and only sure method of discovery, by the study
of anatomy and physiology, the practical observation of disease, and
the deduction of legitimate conclusions from the facts observed.

These ancient opinions, so pernicious, and so generally believed
and acted upon, were first called in question by Prosper Alpinus,
and exposed by the genius and eloquence of Baglivi; Frederick
Hoffman, however, was the writer who may be said to have brought
the humoral system into the greatest disrepute.   He considered the
solid constituents of the animal economy as the most elementary
vehicle; that they were alone endowed with life, and were the pri-
mary seat of disease.   The fluids were considered by him as merely
consequences and necessary effects of the changes which the
solids undergo, and he hence called them the "solidum vivens;"
and supposed that it was the action of this principle upon the
fibres, that gave them the energy and activity, by which their mo-
tions are performed.   He admitted the sensibility and irritability of
the solids as the basis of his system, and the corruption of the hu-
mours as a principle of irritation.   These opinions were strengthened
by the writings of Stahl, who flourished at the commencement of
the eighteenth century.

The celebrated Cullen exposed many of the errors of the humoral
pathologists, then taught in the schools; and improved upon the
opinions of Hoffman and Stahl.   He supposed the human body to
be composed of animated organs, regulated by the laws of life, and
superintended by an immediate principle, which acted wisely for the
retaining of health by correcting deviations and supplying deficien-
cies; not from any knowledge and choice of the means, but through
a preestablished relation between the changes produced, and the mo-

tions required, for the preservation of health. This principle, in its various ramifications, regulated every part of his " Theory of Medicine." The action or the torpor of the extreme arteries chiefly influenced the motions which the living principle regulated, and which he supposed depended on the nervous system, having no connexion with the blood.   In accordance with this theory Cullen supposed the proximate cause of inflammation to be a spasm of the extreme vessels.   The eloquence with which he supported his opinions, the justness of many of his pathological views, and the authority of his name, led to its general adoption.

Haller proved the fallacy of Boerhaave's Theory of Inflammation, by a set of able experiments ; he supposed that phlegmon was only a transudation and extravasation of blood into the cellular tissue, as in bruises, accompanied with fever.*   But this opinion is disproved by the fact of no such extravasation appearing in the eye, where it would be seen, or in inflammation of other tissues when the disease disappears by resolution.

Macbride and Platner supposed that the oscillations in the vessels were increased in inflammation, followed by a state of relaxation ; hence, the blood accumulated in the arteries of the part extended to the veins, and was extravasated into the cellular tissue through the enlarged pores.

From the experiments of Haller, which showed that the small veins were more irritable than the arteries, Dr. Marrners supposed that when an irritation was applied to a part, the veins contracted more than the arteries in which the blood accumulated ; increasing the resistance, producing tension and swelling, and increasing the impetus of the blood to the part.   As the blood does not pass freely into the veins, it dilates the lateral vessels and their exhalent. orifices, and so produces swelling, heat, and pain.†

Vacca believed the action of inflamed vessels to be diminished, or to be proportionally less than those of the trunk from which they are derived.   Dr. A. P. Wilson Philip proposed the same explanation ; and by a luminous description, rendered the theory more, generally acceptable.   He supposed the debility of the capillaries to be followed by an increased action of the larger vessels, which termi-

* Elementa Phys. tom. 1. p. 35.   Opuscul. Pathol. p. 28.
† See his Thesis sistens theoriam inflammationis, Gotting. 1792, p. 17.

nates as soon as the capillaries are so far excited, and the large ves-
sels so far weakened, by the preternatural action of the latter, that
the power of the capillaries is in due proportion to the vis a tergo.

In the present day the most generally received opinion supposes
inflammation to consist in a morbidly increased action of the vessels
leading to an inflamed part, with a dilatation of the vessels of the
part itself.

The great error which the ancient philosophers committed was
in endeavouring to determine fundamental properties of matter, and
in searching out the cause and effects of disease, without making
the necessary examination of the structure and functions of the
body of which they treated; and the long and continual application of
such experience to the explanation of the nature of disease. This
slow but certain course was neglected by the ancients. Their in-
dustry was exercised in theorising on a subject, difficult and
very imperfectly known, and their fancies were much oftener em-
ployed than their understanding and reasoning faculties, in build-
ing their theories. Another great objection to the above systems is
their exclusiveness, their confining vitality to the solids, and denying
it to the fluids, which perform such important offices in the animal
economy, and form such a large proportion of the bulk of the body.
The blood thus considered as destitute of vitality, was believed to
act in the system as a mere agent, and to have consequently but an
insignificant effect on health and disease. Such partial views have
acted most perniciously in the advancement of science. How often
do we find, in the instructive pages of the history of medicine,
"that the simple explanation had been long unobserved, or misun-
derstood, which can only be accounted for by the imperceptible
lightness as well as strength of the chains which authority had im-
posed on the mind." But granting the number and reputation of
those who do not allow vitality to the blood, may we not justly
ask: Has their experience been more extensive, their attention more
continued, their perseverance more unwearied, or do they possess
minds more acute, and information more extensive than those who
have believed in its vitality—than Harvey or Hunter? The latter
great philosopher, after much thought, and in opposition to his habits
and prejudices, but with that native energy of mind for which he was
so remarkably distinguished, concluded that the blood is vital. The

great Harvey, by a process of reasoning which resembled, and in some particulars surpassed, that which was afterwards unconsciously employed by Hunter, arrived at the same conclusion regarding the vitality of the blood. The ardour with which Harvey pursued his experiments on the vascular system, and the pre-eminent success with which his exertions were crowned, seem to have led him to suppose that the blood performs more important offices than our increased knowledge of the nervous system leads us to allow: " Idioque concludimus," says he, " sanguinem per se vivere et nutrire; nulloque modo ab alia aliqua corporis parte vel priore vel præstantiore dependet." *

With the information we now possess on the Science of Medicine, it would appear that organic bodies consist of solids and fluids, the first possessing mechanical, chemical, and vital principles, in which the second in a certain degree participate; and it was by allowing one or more, and rejecting others of these properties, that the ancients fell into many of their erroneous speculations concerning the functions of the body. It is only after making due allowance for these principles, that an approximation is made to the truth. It would be requisite to know the degree of elasticity of the vessels, their size, and different anastomoses, the force and tenacity of the blood, the number and disposition of valves, &c. before the mechanical principles of the circulation of the blood could be exactly defined and explained by the laws of hydrostatics; just as the important changes which take place in the stomach, kidneys, capillary vessels, &c. cannot be explained on chemical principles alone, without allowing also for the influence of vital actions in their production.

In extant accounts of vascular diseases, I believe there is still wanting a description of the changes in the blood, which it is the intention of the following Treatise, in a certain degree, to supply. This desideratum seems to be indicated by the following short sketch of the history and present state of our knowledge of the diseases of the vascular system.

The writings of the best medical authors for many ages consisted almost entirely of speculation, based upon a knowledge of some pe-

* Opera Lugd. Batav. 1737, de Generatione, ex. 51, p. 205.

culiar facts or on certain trains of reasoning; and there is such a love of the marvellous, the natural result of ignorance, in the writings of most of the older authors, that it is very difficult to discover the extent of their knowledge of diseased structure. Their descriptions are imperfect, their definitions vague and defective, and their reasoning on the false principles they assume is generally most unsatisfactory. These led them to approximate diseases altogether distinct in their nature, and to refer others to false causes. Hence the unsatisfactory information we find in ancient writings, of some most frequent and dangerous diseases; which can only be explained by the prevalent ignorance of anatomy and pathology, and the want of close and long continued observation.

The history of Phlebitis presents us with an example of such a fact; though we have every reason to believe that it was of as frequent occurrence in the most ancient times, as at present, still it is only very lately that its nature has been properly understood. In the Sursutoh, an esteemed Sanscrit work, and probably the most ancient medical record in existence, it is stated that if severe pain be felt, as if fire had been applied, on opening a vein, warm ghee, &c., should be rubbed over the part. This probably referred to the example in which the nerve was wounded, but may also apply to inflammation subsequent on wounding veins.

We have every reason to suppose that the inflammation of veins not unfrequently occurred in the practice of the ancients as among the moderns. In the writings of the more modern of the ancient authors we have proofs that the occurrence of inflammation in veins had been observed; it was referred to an anomalous class of diseases; such cases can now be distinguished as varieties of the appearances and consequences of phlebitis. In the works of Aretæus a case is related of the inflammation of the vena cava, and the symptoms by which it is to be known, are indicated.* Hildanus gives the description of a case of extensive inflammation of the arm after blood-letting, in which the vein seemed to have participated. †

At this period venesection was considered as an important operation, that required much experience and intelligence for its proper

* De Causes et Signis acutorum Morborum, ch. 8, lib. 2.
† Cent. ch. iv. p. 343.

performance. The occurrence of any unfortunate consequence was imputed to a want of skill; and authors, even the most accurate, might indicate but were little inclined to be particular in the description of what was considered as proving a want of knowledge in their profession. An example of an unfavourable result of venesection occurred in the practice of Marechal, Surgeon to the King of France, and founder of the Royal Academy of Surgery of France, 1696, which had a most unfavourable effect upon his professional reputation: " Cette grande vogue se soutient sans echec jusqu'a l'epoque d'une saignée suivie d'accidens auxquels on attribua trop legèrement la mort d'un seigneur étranger." *

The observing and sagacious Paré has left proofs of his ignorance of the true nature of phlebitis; for the passage in his interesting works, which would seem to have referred to this disease, is so obscure, and he seems so much wedded to preconceived notions, that we are left in great doubt as to the nature of the case he has related of Mademoiselle Courtin, who was bled from the arm, which inflamed and became gangrenous. The accident which occurred to King Charles IX. after bleeding, is considered as a case of phlebitis. He was bled for fever, and when the vein was opened, the king cried out from a very severe pain, produced by the wounding of a nerve. " The arm became very much swollen, the joint could be moved with difficulty, and the whole arm was very painful. A piece of basilicon plaster was placed over the wound, so as to produce adhesion, and over all the arm compresses imbibed with oxycrat, with an expulsive bandage commencing from the wrist-joint to the shoulder, for assisting the determination of the blood and " spirits " to the centre of the body, lest there should take place too great inflammatory fluction of muscles, or other accidents. Some medicines were given for diminishing the pain, and preventing the bad effects which generally follow the wounding of nerves." After having for three months a stiffness in the movement of the elbow-joint, the king recovered completely. †

Sydenham, in his observations on acute diseases, gives the following accurate account of the progress of a case of phlebitis; which,

* Memoires de l'Academie de Chirurgie, tom. 2, p. 23, Nouv. ed. Paris, 1819.
† Œuvres d'Ambroise Paré : des plaies en particulier, lib. x. ch. 41.

in accordance with the received opinion, he supposed to be the symptoms produced by the puncture of a tendon. This did not render less accurate the account of the case, which he gives in the following words : Quandoquidem vero hujus morbi curatio in repetita venæsectione ferè tota stat, quæ tamen ab imperitis chirurgis, et nescio quibus medicastris in locis ab oppidis populosioribus longe dissitis celebrata, miseros a "punctura tendinum," in artûs amittendi,. atque adeo in vitæ magnum discrimen sæpissime conjicit ; non è re fore duxi, rationem huic malo succurendi, si forte fortuna impingatur hic subnectere. Qui vero punctura hujusmodi plectuntur, dolorem non statim sentiunt, sed duodecim horis post plebotomiam se eodem affici conqueruntur, non tam in orificio nuper facto, quam in partibus ad axillam tendentibus, ubi tandem dolor se figit, et tunc maxime percipitur cum brachium extenditur; attamen læsa pars tumore admodum insigni non afficitur, eodem avellanæ magnitudinem vix superanti, sed ex orificio humor aqueus vel ichor quidam jugiter distillat, quod quidem præcipuum puncturæ tendinis diagnosticum est habendum. *

The above passage affords a convincing proof of the care with which this great physician observed and noted the causes of disease; and although the conclusion which he drew was not correct, it affords, with the experience of future authors, the first accurate account on record of the progress of phlebitis : " The patient did not immediately feel pain, which commenced twelve hours after the venesection, and it was not so much felt in the wound as in the parts nearer the armpit, where the pain became fixed, and was increased by extending the arm." The ichor continually flowed from the orifice in the vein, which Sydenham considers the chief sign of the pricked tendon; although this, then the universally received opinion, might have naturally led him to attach less importance to the symptoms, and to suppose some of the peculiar effects of phlebitis to have been the cause of the danger of certain operations, as has been done by later investigators, when Pathology was more cultivated and better known.

The sagacious Dionis, in his Lectures on Operative Surgery,†

* Opera Medica, Genev. 1716, sect. 6, ch. 3, p. 167.
† Cours d'Operations de Chirurgie.

affords proofs of his having seen cases of phlebitis: at page 678 he states that ecchymosed blood round the opening in the vein, or extravasated blood, sometimes forms a small abscess, which suppurates by the opening made in bleeding. This is produced by the person using the arm too soon after bleeding, which produces an extravasation between the skin and the vein. "In persons of a plethoric habit, ecchymosis sometimes occurs in parts abounding in humours, which are ready to deposit themselves upon any part of the body, and flow into the parts emptied by the bleeding. Next day the arm is painful, and is swelled to a great size, and sometimes the inflammation is so acute, that unless proper remedies are employed, gangrene is produced the second day, and the patient dies the third. Such an accident occurred to the wife of an officer in the service of the Queen; and a few months after, the duke of Saint Simon having been bled by one of the most expert surgeons of Paris, a fluctuation formed in the arm, which terminated by an abscess; but this being opened, he was cured in three weeks." *

The treatment he recommends is, to turn the humour, by a large bleeding from the other arm, by cordials internally, and by applying remedies to the part capable of arresting the course of the humours, so as to resolve and to defend it from them. The bad effects of bleeding Dionis supposed to be the consequence of wounding a nerve, or a tendon.

The interesting letters of the accurate and judicious Morgagni prove that he had met with phlebitis without being aware of the importance of the disease, or of its real nature. Thus in the history of the dissection of a female who died 15 days after a severe injury of the loins and pelvis, he found the following appearances:—

"Cordis auricula dextera, et cava inferior vena, concretiones, non sine multa alba substantia, polyposas habuere: quales uterque etiam ventriculus sed multo crassiorem sinistro. Iliaca igitur vena dextera æquo erat latior; at sinistra, ejusque rami, tenues adeo et pallentes, ut rem nunquam antea a me visam miratus, cavæ imum truncum aperuerim. Quo facto, vel magis miratus sum. Nam pro iliaca ejus venæ ostia lineam inveni, ipsius coalitum indicantem, qua in linea duo aut tres parva erant oscula, cum iliaca vena communi-

* Loc. Cit. p. 680.

cantia.   Quam cum secundum longitudinem incidissem, et præter filamenta polyposa, quemdam fibrarum quasi fasciculum introrsum extantem conspexissem ; mox facile animadverti venæ parietes ab uno latere inter se coaluisse, sicque eum fasciculum mentiri, cujus species, manu utraque parietes distrahendo, neque enim perdifficilis erat sejunctio, prorsus evanescebat.   Vena autem, sinistræ arteriæ socia, tertia saltem parte angustior apparuit quam dexteræ : et quamvis complicatos et coalescere incipientes parietes non haberet, habebat tamen inter tunicas nigrum quasi sanguinem et sanguinem fortassis, sed a longo, ut videbatur, tempore concretum." *

Mr. O'Halloran † gives a good description of the disease under the name a species of grangrene subsequent on phlebotomy.   The person in this case felt more pain than usual at the time of the operation, and next day the orifice felt sore.   On the fifth day he was feverish with a husky cough, and the arm was slightly swollen, with a reddish streak over the biceps, reaching to the shoulder. This judicious and experienced surgeon bled him in the other arm, and ordered stupes and poultices, of the warm kind, to be applied to the affected part ; but told the people that he apprehended " things would not go right, as there was not a sufficient degree of inflammation in the parts to form matter, and too much to expect it would disperse."   The hand and forearm became œdematous, and cold ; the pulse very quick, and the cough short and troublesome. In this state he made many profound incisions in the arm near the bend, each an inch long, about half an inch distant from each other.   The corpus adiposum was found swelled and spongy, so that at the depth of an inch he had not pervaded it ; and water as clear as crystal flowed from the wounds.   Three more ranges of incision were made higher up, and from one of the incisions, over the biceps muscle, a table-spoonful of pus spurted out of the orifice. From this time the dangerous symptoms disappeared.   The hot stupes, warm dressings, tonics, and stimulants were continued, and the man recovered.

---

* De Sedib. et Causis Morb. ep. 56, art 10, tom. 7, p. 93.   See also ep. 53, tom. 6, art. 37, p. 536.   Nova editio Lutetiæ.

† A complete treatise on Gangrene and Sphacelus, with a new method of amputation, Lond, 1765, ch. 8, obs. 28, p. 93.

While these cases indicate the occasional occurrence of phlebitis, they prove the ignorance of even the most accurate authors regarding the real nature of this peculiar and dangerous disease. It was reserved for the genius of John Hunter to discover the true nature of phlebitis, and to draw the attention of the profession to the disease. * Unfettered by the opinions of others, he carefully investigated Nature in her diseased state, by which means he arrived at discoveries without always being aware of their importance. His short essay on the Inflammation of Veins affords a curious example of this fact. His attention was first directed to the subject by observing its occurrence after bleeding in the horse, and from analogy he was led to examine the same causes when applied to man. The cases he related proved the accuracy of his suggestions, and drew the attention of the profession to the nature, the frequency, and the importance of the new disease he had discovered. Sasse and Meckel, soon after the essay of Hunter, published an interesting work on inflammation of veins, which more fully directed the attention of the profession on the Continent of Europe to the subject. †

Mr. Sherwen has related two cases of the inflammation of veins which he supposed were produced by the puncture of the nerves in phlebotomy. ‡

The accuracy of Hunter and Sasse's description was denied by many; and the author of the article Saignée in the Encyclopedie Methodique supposes that Hunter was wrong in believing the primary dangerous symptoms of bleeding to affect the heart; as the pain is very severe in such cases at the time of the operation, and therefore he supposes it to be produced by the wounding of nerves or tendons. There are certainly cases in which great pain is produced in performing the operation of venesection, but such cases are very rare, and altogether distinct from what takes place in phlebitis, which often only developes itself many days after the operation. These distinctions were rendered more evident by subsequent authors. Dr. C. S. A. Schwilgué gives a very judicious analysis of what had been recorded regarding inflammation of vessels, par-

* Med. and Philos. Commun. vol. 3, p. 430.
† Dissert. de vasorum sanguiferorum Inflam. Hal. 1797.
‡ Med. and Philos. Commun. vol. 4, p. 210.

ticularly that of the veins; but added nothing to what was then known concerning the disease.* Mr. C. Bell † and Mr. Abernethy ‡ have recorded interesting cases of inflammation in veins after vene-section.

Mr. Travers divides phlebitis into two kinds, in one of which pus is formed, and, by the protracted irritation, putrid fever is pro-duced, which ends in exhaustion, from which, however, recoveries are sometimes obtained. In the other variety adhesive matter or lymph is effused, and the inflammation extends to the trunks of the vascular system, and sometimes reaches the heart, producing a ty-phoid fever, which is speedily followed by delirium, and always termi-nates fatally within a few days. These fatal effects he supposed to be produced by the extent of the internal venous surface which inflames by continuity, and occasions the dangerous constitutional symptoms. §

Mr. Hodgson supposes that inflammation extends in some in-stances to the inner lining membrane of the heart, and believes that the constitutional irritation is the effect produced upon the nervous system by the pus which is secreted into the vessel being mixed with the circulating blood. He describes the symptoms which attend the disease as having a striking resemblance to those of typhus fever. ||

M. Breschet translated Mr. Hodgson's excellent work on the dis-eases of blood-vessels, to which he added an account of the authors who have treated of phlebitis, and gives the history of some inter-esting cases. ¶

Mr. Guthrie supposed the inflammation of veins after ampu-tation to be connected with, or, as he believes, to be a consequence of a diseased condition of the stump. He divides it into the adhesive or healthy; and the irritative, erysipelatous, or unhealthy. The first being seldom observed, is usually cured; the latter is almost in-variably fatal. He gives no opinion as to the cause. **

* Bibliotheque Medicale, tom. 16, p. 190.
† A System of Dissections, vol. 2, p. 281. Lond. 1809.
‡ Surgical Works, vol. 2, p. 147. Lond.
§ Cooper and Travers' Surgical Essays, vol. 1. Lond. 1818.
|| On Diseases of Arteries and Veins. Lond. 1815.
¶ Paris, 1819.
** Treatise on Gunshot Wounds, chap. 3, p. 299.

From the earliest times the attention of surgeons has been direct-
ed to the study of the manner of arresting hemorrhage, which indeed
for ages prevented them from removing the smallest tumours or
performing the simplest operations, by any other means than
the painful and imperfect assistance of burning irons, styptics, and
ligatures round entire members. For the slow but sure method of
observation and reasoning, they attempted to substitute the method
of procedure by reasoning on preconceived and generally false opin-
ions ; their ignorance of anatomy and physiology preventing them
from correcting their errors, and enlarging their views ; so that it is
only a few years since the true principles of treating wounded
arteries were discovered.

For many ages hemorrhage was attempted to be arrested by the
topical application of such substances as were supposed to possess the
property of coagulating blood, or contracting the size of the bleed-
ing vessel ; or of such as, by their sudden action on the living part, re-
duced it to an inorganic mass, which thus mechanically filled up the
vessels. But experience proved that such means were entirely in-
adequate to arrest the flow of blood, and thus to save the life of the
patient in many such cases. The physician despised the assistance
to be derived from the natural sciences; he rested entirely upon
authority, and was content with merely transcribing from the
Greek, Roman, and Arabian authors, whose works were considered
sacred. He was a worshipper of the ancients, at the same time
intolerant, and considered himself the legitimate representative of
the old school.

- It required the genius of Ambrose Paré to discover the simple
process of securing the bleeding extremity of an artery by a liga-
ture, as the best means of stopping and preventing the recurrence
of hemorrhage ; the process he declared was discovered to him by
the inspiration of God ; but all his authority and experience were
required to bring it into use in place of the painful and inadequate
means then usually employed.

It is a subject of surprise to mark the slow improvement which
took place in the treatment of bleeding arteries, after the great dis-
covery of Ambrose Paré ; and this even when anatomy and patho-
logy were attentively cultivated. The cause was the same as that
which had so long retarded the improvement of medicine. When

c

the benefit of the ligature began to be perceived, it was supposed that the artery was obliterated by the swelling of the parts included in the thread; painful, and not unfrequently dangerous consequences were then produced by the irritation, inflammation, and ulceration set up in the tissues sought to be included in the noose; but the artery being of low vitality, ulcerated before the other parts, and secondary hemorrhage then ensued. To prevent this the wound was filled with extraneous substances and dressed with styptics, which were supposed to possess the property of coagulating the blood, coagulation of the blood having been long held the cause which checked hemorrhage. Such means however only increased the frequency of hemorrhage, and caused the ligature to be rejected by many Surgeons.

Surgeons next supposing that the obliteration of the artery by means of the ligature was produced by the coagulation of the blood in the vessel, thought that it was only necessary to bring the sides of the vessel together with the ligature, and to avoid applying it near a large branch, so as to allow a large coagulum to form by the stagnation of the blood. But neither did this procedure answer in all cases; it led to the adoption of large, flat and clumsy ligatures, which were farther sources of irritation, ulceration, and secondary bleeding.

The celebrated Desault discovered that a round ligature drawn tight upon an artery made a clean cut of its internal coat. This was, however, considered unnecessary, and indeed dangerous, by weakening the vessel. Other Surgeons included a piece of cork, wood, or a roll of linen, to prevent the lesion of the artery in the act of tightening the ligature. They likewise fancied that it was necessary to retard the ulceration and consequent removal of the ligature.

The little information which was possessed on the effects of the ligature upon living arteries, was first observed by Professor Thomson of Edinburgh, and the result of his experience was made public in an able experimental Essay by the late Dr. Jones. The experiments here detailed, banished the large thread and flat tapes, the reserve ligatures, cylinders of cork, or wood, compresses, &c., and proved that the security of a ligature was ensured by its dividing the middle and internal coats, which it does without danger

to the outer. In this state the wounded surfaces quickly adhere; and Dr. Jones showed that the permanent obliteration of an artery was affected by the inflammatory adhesion of its internal surfaces.

Ligatures, it is now agreed, should be as small as possible commensurate with strength, and applied so as to produce the division of the coats of the vessel on which the adhesive inflammation depends. When this is accomplished, we seek to lessen the irritation as much as possible. One end of the ligature is cut off at the knot, and the other brought out at the side where it is nearest the surface. The smaller branches of arteries being relatively more fibrous, and possessing more vitality, a small ligature will more easily divide their internal and middle coats; the large ligature divides less completely the larger and more elastic trunks, and consequently increases the irritation, quickens the separation of the ligature, and tends to produce secondary hemorrhage. Hence the vast advantages of small ligatures in all cases.

Formerly, in the treatment of aneurism, the artery used to be exposed for some distance above and below the diseased portion, and tied with two ligatures half an inch from each other. About the twelfth day the ligatures came away with the intervening portion of the artery. By this method the artery was insolated, and its vital powers impaired; and more foreign substance being introduced into the wound than was necessary, the healing powers of nature were weakened. The deep seated artery was secured with difficulty, and the unhealthy portion of the vessel was often necessarily encroached upon, where it could not bear the ligature. Secondary hemorrhage occurred, and great irritation and subsequent sloughing generally destroyed the patient. Mr. Wilson believed that only one patient in fifteen recovered from the old operation for aneurism. The expert and judicious Pott recommended amputation rather than the usual mode of obliterating the artery, and his contemporary, Mr. Bromfield, objected to operate in cases of aneurism.

One of the most important improvements in modern surgery was that of tying the artery at some distance above the aneurismal tumour, where it is more superficial, and healthy. This improvement was first recommended and practised by John Hunter, in 1785; when he performed the operation for popliteal aneurism by tying the femoral artery above the tendon of the triceps adductor muscle ; he merely re-

moved the dilating cause and let the sac remain to be removed by the action of the absorbent vessels. Such has been the success of this operation, that it has for many years superseded every other method of treating aneurism ; and such has been the confidence which it has given to the Surgeon, that every artery within his reach may be tied, with perhaps the exception of the aorta, and even this has been attempted.

PART I.

REMARKS ON SOME OF THE PROPERTIES OF THE BLOOD.

CHAPTER I.

OF THE BLOOD WHEN CIRCULATING.

THE Blood differs in its properties as it is examined when re-
moved from the system, and when circulating through the body.
In the former state it has been minutely and successfully examined;
but, in the latter, much is still required to complete our knowledge
both of its physiological and pathological states.

Blood, as it circulates and flows from the orifice made in a vein, ap-
pears homogeneous; but, when examined with the assistance of the
microscope, it presents the appearance of solid particles, of a flattened
globular figure, diffused through a colourless fluid. This separation
into two portions is found to occur naturally in the capillary ves-
sels, some of which contain the colourless fluid, and others the fluid
part combined with the red particles. As the contents of these ves-
sels soon mix, they are to be considered as filled with the same fluid,
which only suffers separation of its elements for the purposes of
the system. In the combined state the blood forms a fluid which
cannot be imitated by art, any more than the matter of which it is
formed; and in this united state it is endowed with peculiar pro-
perties, one of which is called vitality, which will now be considered.

We have no knowledge of the nature of vitality beyond that
which its effects afford. It is therefore improper, I conceive, to
say that it is confined to solids, and most unphilosophical to declare,
" that the life of fluids is revolting to common sense, because we
are unaccustomed to attribute to them any power of motion, or
indeed of any movement independent of external impulse." Thus
conclusions are drawn before the nature or even the properties of
vitality are known. I shall endeavour to avoid such errors in the
following enquiry, by setting aside the nature of vitality, and con-
fining myself to its effects or phenomena.

The principal seat of vitality in plants is the part which intervenes between the root and the stem : considerable injuries done to this part are always fatal to them. Does this depend on the solids or fluids of the part? or is it not more natural to suppose, that it is due to the combination of both? With such knowledge alone as we now possess, can a line be drawn between living and dead matter from mere physical qualities? and can we say thus far is vitality to extend, and no further?

Were such distinctions as those of solids and fluids to be allowed in considering vitality, at what time should such properties of the blood be examined? when circulating the blood is a homogenous fluid; but, unlike the bile, the saliva, and other secretions, which are not vital, and consequently the same in their natural receptacles as when removed from the body, the blood undergoes important changes when exposed to the air. When more particularly examined in its fluid state, the blood is found to consist of serum, in which is contained a large portion of solid particles, and a substance which is continually changing to a solid state in the body. Thus the composition of the blood appears to be very similar to that of the solids of the body; it requires only a slight change in its condition to become solid, which is its natural state out of the body.

The investigation of the laws which organized bodies obey in their growth, has proved that all commence their formation from a similar low origin; and it is solely upon the extent and development of their parts, that the form and functions not only of the whole animal, but likewise of its several parts, depend.* Such parts as are common to the lower classes of organized beings, are always present in the embryo of the higher; but as the development of certain parts is often arrested, we arrive at the conclusion that the frequency and extent of their absence in monsters is in proportion to the late period at which such parts are developed. Thus we sometimes find the brain, head, and even trunk wanting in monsters; but in all such cases we invariably find vessels and nerves; proving the early period at which these parts are formed, and their importance to the future animal. Another law in the development

* Discovered by the Chevalier Geoffroy Saint Hilaire, (see his Philosophie Anatomique,) and ably developed by J. F. Meckel in his Handbuch der pathologischen Anatomie, &c. See also Bennett's translation of Tiedemann's Treatise on the human Fœtus.

of organized bodies is, that the vitality of parts is in proportion to the early period at which they are produced. Hence the less vitality of bone compared with cartilage, &c. and in a very early period we find both nerves and blood-vessels formed, indicating their high vital powers. These facts are proved by examining the lower classes of animals: in many kinds of Zoophytes, vessels and nerves are found slightly, if at all, developed. If we descend to plants, we find that life consists immediately and essentially in the motion of the sap; in them no system of nerves has been discovered. In trees, the vitality remains during winter in a dormant state, like that of hibernating animals; and it is only on the return of the spring and the renewed motion of the sap that the life and foliage reappear. In plants, heat moves and propels the sap into progressive, as in hibernating animals it moves and propels the blood into circulatory motion. The blood thus performs the same offices in the animal economy that sap performs in vegetables; and as these seem to have no nerves, it is the sap, we may conclude, that performs the vital functions. As we rise in the scale of organized bodies, we find the nervous system more developed, and performing important offices in the animal economy; but, as we have no opportunity of examining the embryo of mammiferous animals, in an early period, we must be content with observing it in oviparous animals, in which we have every reason for supposing that it follows the same laws as in the higher classes. Every animal texture appears to be formed from matter that was originally in a fluid state; the particles of which each is composed having been brought together, and afterwards concreted by a vital process. Many animals which occupy the lowest rank in the series, such as Medusæ, approach nearly to the fluid state; appearing like a soft and transparent jelly, which after death is resolved almost wholly into a limpid watery fluid. As we ascend the scale of animals the proportion of solid matter increases, and that of the fluids diminishes.

In the embryo of inferior animals, the blood seems to be developed at such an early period, and is, therefore, so peculiarly vital, that it is found even before the vessels which are to contain it.* In the

* " Quantum," says Harvey, " ex accurata inspectione discernere licuit, fit sanguis antequam punctum saliens efformatur." (¹)

(¹) Ex. 51, p. 199.

yellow membrane, or yelk of oviparous animals, a small rent is
first observed, filled with transparent fluid.* This changes to a red
colour, and in it there commences a series of movements which
terminate in the development of the chick ; this is the product of
the vital principle acting through the agency of the blood. The
same is most probably the case in the embryo of the higher classes
of animals. Such changes are peculiar to the blood ; from which
coagulable lymph is, in certain circumstances, secreted, forming
granulations which become vascular, by the inherent vitality which
this secretion derives from the blood. The red specks remarked by
John Hunter in the centre of granulations, are the first step towards
the formation of new vessels in them. In this case, as in the rent
in the yelk of oviparous animals, the vessels are formed by the
closing of these grooves, which, elongating, their contents become
active agents in the growth of the animal, and are consequently
conveyed to parts in proportion to the rapidity of their develop-
ment. † We thus find that the blood is formed at a very early
period, and that the importance and vitality of parts are in proportion
to their early formation :—must we not conclude, therefore, that
the blood is possessed of vitality ? How different are such proper-
ties from those of matter ? This resists any change from its present
state, whether it be of rest or motion ; and possesses natural
powers, as gravity, attraction, repulsion, and elasticity, which are
impulses or forces impressed upon it *ab extra*. The same does not
apply to organic substances. When we view the drop of liquid
blood in its primeval state, can we suppose that the something called
life is a functional effect ? When we view its offices and mark its
changes in different animals and states, does not our understanding

* " Ces ramifications," of primary vessels, " resultent d'abord de petites vesi-
cules arrondies, separées les unes des autres, qui se forment entre les deux mem-
branes du jaune, à ces cavities, s'en reunissent peu-à-peu de nouvelles qui com-
muniquent entre elles, et donnent naisance à un reseau vasculaire pres d'elle."(¹)
" Au commencement, l'embryo n'est qu'un mollicule presque tout-à-fait li-
quide." (²).

† Prima autem omnis formationis rudimenta contemplaturis occurrit ortus
manifestus a fluidis sine quibus millare unquam organicam formam natura crevit.
Curtii Sprengel, Institutiones Medicæ, tom. 1, p. 102.

(¹) Dict. de Medecine, tom. 15, art Œuf Humain, 344, by M. Ollivier.
(²) Beclard, Anatomie Generale, p. 113.

declare the negative, and unhesitatingly conclude that vitality is not the consequence of certain effects, but a primitive something attached to the liquid drop, like the natural powers of matter; a something bestowed by consummate wisdom and power, which develops the body to a beauty of structure and adaptation that can only be viewed with wonder and astonishment.

After the animal has arrived at such a degree of development as to admit of a separate existence, the food taken into the stomach undergoes changes, by the vital action of the organs, which reduces it to chyme ; from which, by a process peculiarly vital, the absorbents select what is proper for the formation of the chyle. While in the lacteals, it undergoes certain changes in its quality, before it enters the system to renovate the blood and restore the waste it had experienced in nourishing the body. The blood thus prepared and changed, by the vital properties of organs, seems only fitted to perform its numerous and important offices in the animal economy by that portion of vitality which it possesses. By this property it is enabled to adapt itself in point of quantity and quality to the wants of different tissues and organs; at one time depositing solids, and at another absorbing them, to assist in the nourishment of the body, when it has not received its supply in the usual manner. By changes thus induced in the blood, it is continually altering its vitality, as it proceeds in its course; at one time discharging, and at another receiving extraneous matter, which in its turn undergoes changes for the purposes of the economy.

The degree of vitality in parts is always in proportion to the quantity and quality of the blood conveyed to them ; the blood forming a large proportion of the bulk of the body, and the activity of the functions of the circulation varying with the local vitality of the blood, as it circulates, being greater in the arteries than in the veins. After having stimulated the nerves and organs, and imparted a portion of its properties by means of the extreme vessels, it is returned in the veins enfeebled, to be again renovated in the lungs.

When vitality in a part is preternaturally augmented, the arteries increase in size, and throb with unusual force, so that more blood is sent and circulated through it, and the part appears red and hot, and the secretions are increased; as in the antlers of the male-stag, when

they are renewed.   The general system is found in the same state in infancy, when the blood is in a large proportion to the bulk of the body, which rapidly increases in size.   As we follow the progress of an individual through life, we find the quantity of blood diminishing towards decrepitude, when the arterial action is weak, the pulse frequent, and the body emaciated.   When the principal artery of a limb has been tied, the anastamosing vessels enlarge slowly, and the limb remains weaker than natural.   In this state cold is felt more severely, from the diminution of vitality ; the part is more easily inflamed and ulcerated than usual, and there is a diminished power of reparation in the part.   Sir A. Cooper relates the case of a man, who after undergoing the operation for popliteal aneurism, had a lotion of the acetate of lead applied to the limb by an ignorant pupil ; when the bandages were removed the following morning the limb was found mortified.*   Thus it appears that the blood enters into the composition of every part of the body, that the peculiar secretions are all derived from it ; that it produces and augments solids, and when the supply of blood ceases in a part, the part dies.

These facts are proved, by removing blood from a part or from the general system ; the action of the vessels is thereby reduced, and the strength of the system diminished in proportion to the quantity and the rapidity in which it is removed.   By this powerful therapeutical means, the vitality of the blood can be reduced when too high ; in this state the action of the absorbents is increased, and the new matter introduced into the circulation is of more liquid quality, and of lower vital properties.

So great is the importance of the blood to life, that in proportion to the vascularity of a part is the rapidity of repairing injuries. This may be proved by passing a ligature round the principal artery of the limb of an animal, and observing the effects on a wound made in the two extremities.   It will be found that the wound of the limb in the natural state will heal in less than half the time that the one in the other limb requires.   As the circulation is quicker near the heart than in the extreme parts, particularly when the blood returns against its own gravity, a wound near the centre will heal more rapidly, *cæteris paribus*, than in an extremity.   Hence the diffi-

* Medico-Chirurgical Transactions, vol. 3, p. 251.

culty of curing ulcers of the legs, in old people, &c. compared with those in the young, and in the trunk and arms of the same individual. These differences depend on the difference of circulation, and the consequent vitality of the several parts.

The circulation of the blood has thus a tendency to equalize vitality over different parts of the body, and instead of its irritating and inflaming the tissues of the body, as it would be liable to do by any change in its properties were it inorganic, its vitality enables it to vary its properties as it is sent to different organs to perform its peculiar offices, and to throw off by secretion what may be pernicious to its constitution. The blood thus becomes the principal cause and support of life, by being resolved into different fluids and solids; and as it circulates through the body it is able to resist powerfully the influence of external agents, as cold, &c., which would otherwise destroy parts more particularly exposed to their influence: by the continual circulation of the vital fluid through all parts of the body, a powerful resistance is offered to the destruction of life by deleterious agents; the blood in the external and more exposed parts is renewed from the internal parts and the vitality maintained. In this manner a member does not die when exposed to great cold, until the circulation is destroyed in the part, and the vitality of the whole mass of blood is weakened. Should the application of cold continue and this weakness increase, so as to penetrate through the bad conductors, which the structures of the body form, to the internal organs, congestions of blood are produced, the person becomes torpid, and at length dies.

The above facts will prepare us for examining other vital changes in the blood, which are either sthenic,* tonic, or of that nature which disposes the body to inflammatory diseases: and the opposite state or that of debility, which produces the asthenic or atonic class of diseases.

---

* In the present state of medical knowledge it is impossible wholly to avoid the language of theory. " The corruptions of false doctrines must remain more or less in our phraseology after the doctrines themselves are exploded; since custom has rendered the expressions on which they are founded intelligible; and human sagacity has not as yet discovered those first principles of living motion, by which the doctrines and the language of physiology might at once be reformed." Hence the term Sthenic is applied, according to its original acceptation, to denote an increase of vitality, or organic action in the blood.

BOOK I.

OF THE BLOOD IN STHENIC DISEASES.

These remarks will bear reference to natural and preternatural increments of vitality in the circulating fluid. Under the first will be considered Plethora ; and under the second such changes as the blood undergoes in its natural receptacles—veins, the heart, arteries, and capillaries. I shall then speak of the changes which it suffers when thrown out upon vital tissues ; and finally, of the alterations it exhibits when removed from the body.

The constituent principles of the blood in perfect health are always nearly in the same proportion ; and every considerable deviation from this constitutes disease. Some of these changes in the properties of the blood will be considered under the head of natural and preternatural increase of its vitality.

CHAPTER I.

NATURAL INCREASE OF VITALITY.

The natural increase of the blood's vitality is either local, or general. In the first case it takes place through the medium of the natural tissues in which the blood is contained for supplying the waste of the body. The nutritious fluid is deposited in a sero-gelatinous form, which changes with the natural structure of the part. Thus, the trunk of an artery may send a branch which supplies bone with nourishment, and another which supplies the waste of muscular fibre ; and when a part has been wounded, so that ligaments, muscles, bones, &c. are injured, we find that the arteries of the cut surface secrete coagulable lymph in the form of granulations ; these granulations possess vitality ; vessels are formed within them, as in the yolk of the egg, and changes gradually take place in the secretion, by which tissues are formed possessing the properties of those which had been injured, as skin, muscle, &c. The bone in like manner is slowly formed, the deposit being first made in the form of cartilage, into which the osseous matter is secreted.

When any part becomes diseased, the tissue of vessels is generally first affected, and this influences their functions. The blood which the vessels contain is particularly affected in its vital properties, and often forms the chief feature in the disease. In the absence of a more intimate knowledge of the effects of these causes upon the tissues, such changes may be considered as constituting disease of the fluids, as physical changes in tissue are considered diseases of the solids.

Plethora.—Morbid increase in the general quantity of blood produces plethora; but it is not always increased absolutely, though it is more than the vessels can bear, without distention; by which it is propelled with greater difficulty, and the time it takes to circulate through the body must either be increased, or the forces by which the circulation is accomplished must be augmented. Hence it appears that when the quantity of the blood is increased, and the propelling forces are augmented, the state of plethora is produced.

In some cases, the vascular system is so irritable and weak, as to produce a sensation of fulness without any unnatural increase in the quantity, but only by a change in the quality of the blood. This is the case in some fevers, in which the blood has a denser cruor than natural; here the pulse is constricted in the same way as it is when affected by cold, and may be suddenly changed to a soft feel by a dose of opium, or of digitalis. This is an example of the small degree of reliance that should be placed on the state of the pulse alone, as indicating the quantity of the blood in the body; nor can such varieties be exactly ascertained. It is however most probable that in some diseases the absolute quantity of blood is increased, and in other diseases diminished.

Plethora thus implies a permanent fulness of the vessels, and predisposes to inflammation. The causes of plethora may be referred to artificial and to natural causes.

1*st.*—The artificial causes are such as increase the quantity of blood in the system, by diminishing permanently the quantity sent to one part of the body. Such causes act by producing an external or internal hemorrhage. Epistaxis is an example of the first form; and is produced by exposure to heat, stooping the head after violent exercise in the young and plethoric. The flow of blood is usually preceded by headache, tingling of the ears, a sense

of a fulness about the forehead, and upper part of the nose.   In
some cases the person has shiverings, or chills and heats; the face
becomes red before the bleeding comes on, and the blood generally
flows from one nostril in rapid drops, but sometimes in a stream.
When violent, the blood flows from both nostrils in such quantities
as to produce faintness.

2nd.—Internal congestion and extravasation of blood are liable to
occur in the adult or old persons after frequent small bleedings, which
produce plethora by the system supplying blood for the habitual
waste which the evacuation had caused.   Sudden cessation of habi-
tual evacuations, whether natural or preternatural, free living, the
frequent use of warm baths, indolence, &c. all dispose to ple-
thora.   In a healthy individual who loses an extremity, an accu-
mulation of blood takes place in the system, and unless a con-
siderable quantity of blood be lost at the time of the operation,
there is danger of the bad consequences of plethora following.   This
danger is not merely due to the larger proportionate quantity of blood
in the system ; but likewise to the stomach remaining unimpaired
in its functions, and producing the usual supply of blood for the
whole body, when perhaps one fourth of its bulk has been removed.
Thus more blood is formed than the system requires, and plethora
is induced.   This frequently occurs in young persons, after amputa-
tions in consequence of accidents.   In general, the bad effects of
plethora are avoided immediately after the operation, by the blood
lost during its performance, by the weakness which the previous
sickness had produced in the system, the regimen enjoined after the
operation, and the debility of the stomach.

This artificial plethora sometimes proves fatal soon after amputa-
tions in persons of full habit when little blood has been lost during
the operation.   In these cases the local congestions usually take
place in the lungs, or head; although they may occur in any organ
predisposed, by being in a state of weakness.   The following is an
example of apoplexy produced by such a state of artificial plethora.

CASE I.—Mrs. Murray, aged 60, of a full habit of body, was ad-
mitted into hospital, on account of a fungous tumour arising from
the heel.   As it was supposed to be connected with a diseased bone,
had extended to the ancle-joint, and involved the tendo-Achil-

lis, the leg was removed under the knee. Very little blood was lost during the operation; but she had scarcely been removed from the operation table, and placed in bed, when she experienced an attack of apoplexy with loss of voice, followed by hemiplegia. She died some days after; and on dissection, a large extravasation of blood was found in the left hemisphere, over the fissure of Silvius, which had caused death.

Natural plethora occurs at different periods of life. Persons under puberty have an arterial, and persons in old age a venous, plethora. In the first case the body is of a firmer and more unyielding texture, and the pulse is frequent ; the person is liable to the occurrence of active hemorrhages, and inflammatory diseases ; the plump form and rosy appearance here indicate the healthy plethora, and are a more certain indication of this, than the state of the pulse or tongue.

In the old, when the venous plethora predominates, the texture of the body is lax, and feeble, the pulse slow, and the person subject to passive hemorrhage, venous congestions, and apoplexy. The cerebral congestions of blood are the most common and dangerous form of this disease, which generally commences with great weight and pain of the head, to which the hand is often raised, with twitching of the muscles. The person becomes sleepless, watchful, with a state of excitement of the moral and intellectual faculties, or incapacity of attention, hesitation in speaking, loss of memory, &c. the eyes are at times suffused ; there is redness of the conjunctiva and face, and beating of the temporal and carotid arteries. The pulse is strong, hard, and frequent. The respiration is more or less affected, but rarely is there stertorous breathing. The members are heavy and inactive, with a disagreeable tingling, or paralysis, more or less complete, of parts or sets of muscles. These symptoms recur in paroxysms, so that a few hours after the attack they decline, and the indications of approaching paralysis disappear. The rapid invasion and cessation of all the symptoms characterize this dangerous disease, which is produced by an enlargement and congestion of the vessels, particularly the veins, of the brain and membranes, which are often followed by an extravasation of blood in the substance of the brain. The same effect may be produced by contusions and injuries of the head.

CHAPTER II.

PRETERNATURAL INCREASE OF VITALITY.

The second or preternatural changes in the blood take place in this vital fluid itself; which no longer remains in the fluid state, but is converted into a homogeneous, red, solid mass, or it consolidates.* As this change takes place from the increase of vitality in the blood itself, without the necessary intervention of any vital action of the tissue of the vessel, it more slowly changes into other forms. This important principle may be considered under the heads of—

    I.—Sthenic changes in the blood, as observed when removed from the body.

    II.— ——When effused into vital tissues.

    III.— ——In the blood's natural receptacles; or in the veins, in the heart, in arteries, and in capillaries.

SECTION I.

Sthenic changes in the blood as observed when removed from the body.

When blood is removed from a person in robust health, being allowed to trickle slowly from a wound, or exposed freely to the air in any other way, it immediately coagulates: The exposure has the effect of destroying vitality and hastening the chemical changes which the different ingredients which enter into the formation of the blood are disposed to undergo. This is more evident when the blood is removed from veins than arteries; on account of the difference of their vitality. Hemorrhage diminishes the vitality; as the blood flows, it becomes thick, coagulates quickly, and so serves as the means of preventing future effusion by coagulating and filling up the open mouths of the vessels.

If a stream of blood be received in cold water, it does not coagulate, although after coagulation it is insoluble in water. When death occurs suddenly, the blood does not usually coagulate. I examined the body of a man who died suddenly from the bursting

---

  * I employ this word, in opposition to the term coagulation; which is generally used to designate the peculiar change which the blood undergoes when removed from the body.

of an old aneurism into the pericardium, and found that the blood remained fluid. In this case the temperature of the body continued high unusually long, and putrefaction rapidly occurred. In such cases the sudden destruction of vitality, and an alteration in the fibrin, appear to be the cause of the peculiarities observed. In confirmation of this opinion, putrefaction in a mass of blood is found to be resisted in proportion to the size and firmness of the coagulum; and Wilson, in his lectures on the blood, states that he found the blood only thickened, when no more than a few minutes intervened between the attack and death.

At the natural temperature of the body, 99°, coagulation takes place more slowly, *cæteris paribus,* than either above or below this temperature: at 120° coagulation takes place immediately.

When blood is effused in a full stream, and is received into a deep vessel, so as to be as little as possible exposed to the influence of the air, vitality is longer retained, and several minutes elapse before coagulation commences; the length of this time forms a means of estimating the degree of force or vitality which the blood possesses.

This important fact is proved by experiments on animals. In the dog, sheep, horse, &c. the blood is found to coagulate more slowly in proportion to the vital powers of the system; so that when portions of blood are taken away from time to time, as an animal bleeds to death, it is found to coagulate more and more quickly as the animal sinks.

In weak states of health, when blood is removed from a vein, it quickly coagulates; but on examining the blood in youth and health the coagulum forms slowly; this change is still more tardy in blood taken from arteries, and from the neighbourhood of an inflamed part, although under such circumstances the blood contains more coagulable lymph than that of veins, or weak individuals. When blood is possessed of inferior vitality, it is dark, thick and half coagulated.

The increased fluidity and slowness of coagulation are better marked in blood which has been taken from a vein that proceeds from a part under a severe attack of inflammation. The inflammatory diathesis is marked by a hard and generally strong, full, and frequent pulse, under which circumstances a much larger quantity of blood may be removed from the system than in ordinary circumstances;

by which the system is weakened, and restored to a more healthy state.

In this manner many of the circumstances connected with inflammation may be explained; the individual is excited in an unusual degree; the circulation is more rapid, and the blood is more fluid in its consistence, and florid in its colour; when removed from the body it also forms a larger and tougher cruor. From the increased action of the heart and more fluid state of the blood, it is more copiously distributed throughout the body; and there is a greater disposition to the formation of new tissues, and an increased density or organisation of the parts particularly affected.

By this morbid stimulus of disease on the system, it becomes exhausted; disease is followed by prostration, which requires rest for its restoration. In like manner when vitality has been suddenly destroyed, the want of coagulation and rigidity hastens putrefaction. Thus when animals have been much exhausted by work, before being killed, the vitality being diminished in force, less perfect coagulation takes place, and the meat is tender, and becomes more rapidly tainted. The people employed at the curing houses find that the flesh of oxen killed immediately after having been driven from some distant part of the country soon becomes putrid, and will not take the salt; the cattle, therefore, are fed, and rested after the journey, before they are killed.*

The causes which increase the mass of the crassamentum, and the rigidity of the muscles after death, are all such as have a tendency to increase the vigour of the body in health. For this reason the blood coagulates in a firmer, larger, and redder mass when taken from the arteries, than the veins; and in the young and robust, than in the old and infirm; which seems to prove that the size of the coagulum, the density and the redness of the blood, are increased or diminished as its vitality is strong or weak.

By the peculiar property of the blood of coagulating quickly during a state of weakness is explained a beautiful resource of nature in cases of hemorrhage. In such cases the person feels faint, the head giddy, the extremities cold, and the heart's action is slow and weak; a cold perspiration suffuses the skin, and fainting ensues.

* Wilson on the Blood, Lect. 1, p. 25.

These symptoms are produced by the want of the usual stimulus to the brain from the diminution in the vitality of the blood. This diminution is peculiarly evident in the blood itself, which is thicker, darker, and capable of forming more quickly a soft coagulum; so that if the hemorrhage has taken place from a large vessel, time is allowed for the blood to coagulate, and t he vessel to be closed before the action of the heart is again excited. When the hemorrhage takes place from arteries, although the blood coagulates slower than in veins, this coagulation nevertheless often preserves persons' lives in cases of wounds. The peculiar changes in the blood men- tioned go on increasing, as the person dies from hemorrhage.

When a person is stunned by a blow on his head, or by apoplexy, the blood when removed from the system is thick like that from a strong individual, of a dark colour, and coagulates quickly into a large soft crassamentum, without showing the buffy coat. As the blood flows from the wound in the vessel the oppression is removed, the pulse rises, recollection returns, and the blood again takes longer in coagulating.

When the system is in an unusual degree of tonicity beyond that of health, the crassamentum appears much tougher than natural, with a white surface; from the larger quantity of fibrin than usual.

This white surface is called the buffy coat, and is generally observed when there is any unusual central action, as in pregnancy; when the blood is found thinner, and the lymph more attenuated; on which account the pulse is accelerated, with signs of plethora.

When local irritation is severe, it quickly affects the system; but in a diminished degree, so that the first cup of blood removed from the general system is often neither buffed nor cupped, when the second is so; indicating the local action of the irritation, and requiring some of the healthy blood to flow before the diseased portion reached the orifice.

A boy 18 years of age had a severe inflammation of the middle finger and part of the hand. On account of the tension the parts were divided, but no pus was discharged, and he lost a few ounces of blood by placing the hand in a warm bath. An hour after, I opened a vein in each arm, making the wound nearly the same in both. The veins in the diseased arm were more distended, the blood flowed

nearly twice as fast, had a more florid appearance, was cupped, and had a thick tough buff which entirely separated from the vessel. The blood from the other arm was neither cupped nor buffed, was attached to the vessel on one side, had a flabby appearance, and was evidently less tough.   In other more severe cases the disease appears to affect the whole system ; which is indicated by the full, hard, and quick pulse, when a buff appears upon the first cup, and disappears in the second cup, or in subsequent bleedings ; indicating that the general irritation is much diminished.

In inflammatory diseases, or when any great arterial action is going on in a part, as when an injury is repaired or a new part is forming, the blood is found more limpid, of a more florid colour, with a large, firm cruor which contracts into a concave form, on its upper surface, which is nearly deprived of the natural colouring matter.   This consists of a larger quantity of fibrin than natural, mixed with albumen in the serum.   In such cases it is found that the red globules separate more easily from the blood, and from their greater specific gravity sink to the bottom of the vessel ; and Mr. Hewson found that the red particles subsided more quickly in this blood than in the serum alone, when separated.   Which proves that the serum is not so thin as the changed coagulable lymph.

This white appearance on the surface of coagulated blood is called the buff, and in some cases, says Mr. Wilson,* I have found the cruor entirely devoid of red particles, which were found loose, and disentangled at the bottom of the vessel.

The important office which the coagulable lymph performs is proved by its being found to be a constant ingredient in the blood of animals; it is the part which is the medium through which the growth and preservation of the body are accomplished, and appears to be the medium which nature employs more particularly for conveying life to the different parts of the body.   When parts have been divided or injured, it becomes the bond of union, and in it are new vessels formed, and the tissue changed.   To supply the loss of parts, lymph is deposited which becomes organized, and forms granulations in which vessels are found.

The various qualities of this important principle of the blood are

* C. C. p. 53.

very numerous; its quantity, fluidity, slowness of coagulation, and its toughness, are the measure of the tonicity of the part. Scudamore found in the first cup 12 grs. in 1000, and in the second not quite 6 grs. He likewise found the largest proportion of fibrin in cases of inflammation of fibrous membranes; next, perhaps, in pleurisy and acute rheumatism.

The following are some results of experiments made for determining this point.

In some cases of weakness, when blood is removed it has an increased tonicity; the coagulation is quicker than natural, and the buffy coat sometimes appears of a more gelatinous appearance, softer in its nature, and less contracted and concave than in inflammatory diseases.

In an old woman, aged 60, who had an inflammation of the brain, there was no serum separated from the blood, and one half of the cruor was composed of a tough buff, which adhered to the sides of the vessels.

In a case of pneumonia the blood was taken in a free stream. The first eight ounces soon showed the buffy appearance, and in ten minutes had coagulated and presented a white surface. The coagulable lymph continued to contract for a considerable time, took on a concave form, separated from the sides of the vessel, contracted at length into a rounded form, with a bulging of its lower half. This upper part was so tough that it could not be divided by the handle of a spoon. The second cup did not coagulate for ten minutes. The blood in a case of acute rheumatism was buffed to the extent of nearly an inch. The woman was young and very fat, and the buff had much the appearance of lard. The buff was not very tough, nor was it cupped.

In a case of strangulated hernia the blood was cupped and buffed, with sharp puckered edges, with a quantity of gelatine adhering to the sides of the buffed portion, and floating on the serum. In another case of strangulated hernia which happened to an old woman, violent symptoms of peritonitis occurred, and she died in a few hours. Some ounces of blood were taken from the arm after the violent symptoms had commenced; it was but slightly cupped and buffed. The crassamentum was large in this case, and there seemed not to have been time for the whole constitution to

become affected before the feeble life of this individual was destroyed.

In a case of acute dropsy from cold the blood was cupped and buffed, and very tough, with milky serum. Two days after, the same man was bled again, and the blood was found still more cupped and buffed, and the serum still milky and thick.

During the healing up of sores or wounds, the crassamentum is usually large. In a man in whom the brain became affected subsequent to the healing up of an old ulcer in the leg, the blood from the arm had a thick coating of buff, which was firm and attached all round to the vessel containing it; no serum appeared. In a person with a fracture, in whom a feverish state was produced, the blood was cupped, buffed, and very tough, and half an inch thick. The serum was in considerable quantity, and of a yellowish colour.

We know that a buff will appear upon the blood, when some minutes after it has been in the bason its surface has a livid blueish tinge, and not the florid colour it had immediately after leaving the vein. On a close examination a transparent fluid may be observed upon the surface, which may be skimmed off without any admixture of the red particles, and consists of coagulable lymph.

When secreting vessels are inflamed they secrete more than in their natural state, and it is found that these secretions contain more coagulable lymph than natural, which quickly condenses. When its physical and chemical qualities are examined, lymph is found to be identical when effused upon inflamed surfaces, as when upon the blood it forms the buffy coat. The great degree of buff upon blood in inflammations of serous membranes is probably owing to implication of the vessels which supply the secretion of serum.

From the above facts we conclude that the vividness of the colour, the thinness, the slowness with which coagulation takes place, and the toughness of the coagulum, are always in proportion to the degree of vitality of the blood, which may be increased generally or locally; they afford admirable resources of nature in defending itself from the effects of an injury, or the irritation of an extraneous body. In such a state the blood more readily deposits a portion of its contents by the increased secretion of lymph, which surrounds and insulates the irritating cause. This is followed by an increased action of the

absorbents either to remove the offending body, or to insulate it more completely.

When the local cause is more severe, it affects the general circulation, and an excited state is produced in the arteries, called inflammatory fever, and an increased and modified coagulum. This, however, does not take place immediately on the development of local inflammations; which explains wherefore the blood is often at first without the buff, which afterwards forms, and becomes better marked as the system is more affected by the presence of the local inflammation; on this account it is that the blood which is removed at an early stage of a local inflammation is found thicker, of a darker colour, the cruor less firm and cupped, and containing less of the buffy coat than upon subsequent bleedings.

The quantity of serum is usually in the inverse ratio of the strength of the system; and by bleeding it is proportionally increased, and absorption is promoted. It is likewise proportionally diminished when buff appears upon the blood, although it often appears in these cases in considerable quantity from being more completely pressed out by the denser mass of cruor as it coagulates. By this tendency to consolidation and separation of the serum, is explained the frequency of dropsy in cases of inflammation. This occurs more frequently when a serous or synovial membrane is affected with a certain degree of inflammation which does not proceed to adhesion. In cases of such membranous inflammations the serum is slightly altered from its natural state, and generally contains more or less flocculi of fibrine according to the degree of inflammation. When severe the more limpid state of the coagulable lymph enables it to penetrate to the exhalent vessels, when it is secreted more copiously than in health.

In cases of debility the crassamentum is large and soft, with little serum, from its being imperfectly pressed out from the solid mass.

The chemical principles and specific gravity of serum are changed in disease; being more attenuated and increased in quantity in sthenic, and diminished and containing solid matter in asthenic diseases.

The depth of colour of serum is increased in acute diseases. In fevers it is often greenish and straw-coloured, orange, or bilious yellow.

In other cases of acute disease it has a mjlky appearance. In that peculiar disease—cholera, the blood has a diminished proportion of serum, from the copious secretion into the intestines, so that there is frequently a difficulty in withdrawing blood from the veins. It appears in such cases dark coloured, and thick, which proves its imperfect renovation in the lungs, as well as in its imperfect calorification, from the blood circulating only in the large vessels; such facts explain the weakness and the interruption to secretion, &c.

Dr. Stevens, in his Observations on the Healthy and Diseased Properties of the Blood, (Lond. 1832,) supposes the "florid appearance of the blood to depend on a larger proportion of those salts which are, in reality, the true cause of the fluidity, stimulating power and florid arterial colour of the blood; when the salts of the blood are lost or greatly diminished, it becomes black, vapid, and no longer capable of making the heart contract. All acids, alkalies, electricity, and poisons blacken the blood, among others carbonic acid, which the oxygen of the air removes in the lungs and produces the changes in its colour."

It is, however, to be recollected, that when the blood is florid it not only contains more salt, but likewise more of the dense part or solid cruor. This is a more probable cause of the nourishing power of the blood, than the larger quantity of its salts alone. In consumption, when the blood is imperfectly changed in the lungs, &c. does the heart beat less frequently, or the blood lose its colour? How are we to explain the evidence on record of the black putrid blood in scurvy being produced by the salt food, and of the state being best removed by the use of vegetable acids? Exceptions to such a plan of treatment in such cases have been brought forward by Dr. Stevens, and the advantage of following an opposite plan,— but we require experience before the ancient and well authenticated opinion as to this treatment is shaken.

I do not consider it necessary to enter into any further refutation of this opinion, which is neither borne out by experience nor reasoning, and is at variance with numerous established facts.

In deciding on the property of bleeding, we may be regulated by the fluidity and colour of the blood, by the time it takes to coagulate, and by the toughness of the cruor, after making allowance for the state of the part affected, the quickness with which the blood

has been removed, and the shape and nature of the vessel into which it was received.

Sthenic changes in the Blood when effused into vital Tissues.

When blood is effused into a vital tissue its inherent vitality is retained for a considerable time, varying with its quantity and quality, and with the vitality of the part into which the blood has been evacuated. These effusions may be divided into such as occur in vital organs, which are not influenced by exposure to external inanimate agents, as the contact of air, &c. and,

2ndly, Blood effused into vital tissues which are in contact with air.

The degree of vitality which the blood possesses is more easily retained when evacuated from vessels into vital tissues, where it is not exposed to the influence of external agents.

When a slight ecchymosis takes place under the skin, the blood appears dark, and soon consolidates. The absorbent vessels are increased in their action by the irritation of the extraneous mass, which changes to a yellow appearance, and is dispersed by absorption.

When a large effusion of blood takes place into the cellular tissue of a strong individual, from the rupture or wound of a large vessel, as by an injury which does not expose the bleeding vessel, it may remain for a long period in a fluid state in the circumscribed cavity, while that portion which is in contact with the surrounding vital tissue consolidates.

These changes may be frequently seen in the scalp, where the skull prevents the blood from extending to a great depth. In this case, when the effusion is not great, a complete consolidation of blood occurs, forming a hard swelling; but when the effusion is considerable, a partial consolidation becomes evident round the cavity in the vital tissue, as indicated by the hard elevated edge and soft centre, a state of things which constitutes the characteristic tumour of the scalp.

It is of great importance to the complete recovery from such an extravasation, to allow nature to remove it, which may be assisted

with pressure, &c. rather than destroying the small remaining vi-
tality that such blood possesses by exposing it to the air, and thus
rendering it similar in its action to a foreign body, which irritates and
inflames the part. Even when inflammation is threatened in such
a swelling produced by extravasated blood, we should use means to
remove the irritation, and only open and evacuate the sac when
resolution cannot be attained.

This slow vital change in extravasated blood exhibits a beautiful
resource in nature, by which time is afforded for the formation of
a sac, by the irritation which the injury produces in the surrounding
parts, and the adhesive inflammations which close the wounded ves-
sels, so as to admit of the dispersion of the effusion by absorption.

These changes will always take place more readily, *cæteris pari-
bus*, in proportion to the small size of the vessels wounded, from
their possessing more vitality. Should a part into which the effu-
sion of blood has taken place be in a state of inflammation, a more
perfect consolidation of blood follows, a rapid change in colour and
organization occurs, and hemorrhage from vessels more readily
ceases.

By a parity of reasoning, which experience has proved to be just,
the different parts of the blood are acted on by the surrounding parts
in proportion to the vitality of the blood and the parts. Highly
vital extravasated blood is quickly changed, and removed by the
neighbouring vital tissues; but, if less so, it remains fluid; the
fibrine is more acted on and removed by the neighbouring parts; the
red globules and serum being left, and if in considerable quantities
die, irritate the surrounded parts, and are evacuated by the effects of
inflammation. In this manner we explain how the blood drawn by
the leech coagulates at first; but if allowed to remain in its body,
and the animal recovers from the engorgement, the blood it con-
tains is found converted into a dark thick fluid, which does not coag-
ulate on exposure to the air, in consequence of changes produced in
the coagulable lymph. We thus explain why gorged leeches so fre-
quently die if the blood is not removed; unless strong they are not
able to retain in life the blood they have sucked; it coagulates, and
the irritation of the dead matter destroys the animal. Death of
the blood is most liable to occur in the weak, and some time after
it has been withdrawn from its proper vessels, when the more vital

part, or coagulable lymph, has been absorbed, and the less vital globules and serum are left.

Should an extravasation of less vital blood take place into the cellular tissue, a larger proportionate quantity will remain fluid, from possessing vitality to retain it in this state, but not enough for its consolidation. But should the neighbouring parts be much bruised, or the individual weak, the extravasated blood will not possess sufficient vitality to retain it in the liquid form; a portion of it coagulates or dies, and acting as an extraneous substance, the parts inflame, suppuration generally follows, and by the aid of insterstitial absorption, the evacuation of the morbid secretion is effected; the dead blood has now a fetid smell from the admixture of pus and the changes it has undergone.

The following is an example of a more asthenic state of the blood, or parts into which it had been effused. " Miss A. came from a distant part of the country, with a tumour encircling the whole throat, almost from ear to ear, and extending from the chin to the sternum. This tumour, the growth of several years, could not be a suppuration of the thyroid gland, for there never had been induration or inflammation, but a sac containing a secreted fluid increasing slowly in quantity, till the tumour covered all the trachea. Like every other great sac, this was far from being tense; it could be pinched up with a finger and thumb, so as to make the uncommon thickness of its walls very sensible to the feeling, and the fluid distinctly fluctuated, and was easily pushed from one side of the cavity to the other. On making an incision through the skin and fascia of the lower part of the neck, and striking a lancet into the tumour, a thin bloody serum ran out, or rather a thin blood; for it coagulated in the saucers, even before it could be turned from them into a larger basin. It exactly resembled that thin and bloody secretion which I have so often seen run out, upon making openings round the knee-joint, or into swellings the consequence of a shock or rude blow, or in consequence of high and sudden inflammation. Even after strains of the muscles, without any external injury, I have seen many such effusions of [serous-looking] blood.

In the evening when the plug was withdrawn, the same thin bloody serum flowed from the sac, and instantaneously coagulated, and at each dressing, during the first four days, the fluid which was

discharged seemed little different from pure blood. It was plainly a sort of secretion from the thick walls of the tumour, which gradually became less coagulable, very thin and whitish, and ripened before the tenth day into pure and well conditioned pus, importing that the internal surface of the sac was in a state of suppuration and inclined to heal."*

In this case the state of the blood proved that it possessed such a degree of vitality as to retain it in a fluid state, so as to prevent its coagulation or death; but as soon as exposed to the air, this change rapidly took place. As the blood was evacuated, the sac was again filled probably from a neighbouring vein, the bleeding orifice of which was imperfectly closed with consolidated blood. To prevent the refilling of such swellings, gradulated compression should be used, and, as in the above case, it will often be found advantageous to pass a seton across the sac. This is the more useful, as it ensures the degree of inflammation required for curing the wound in the vessel, and obliterating the sac, by the adhesive process.

Should the parts be much bruised round an extravasation of blood, the vitality of the part is diminished, and the life of the extravasated blood is more quickly destroyed. The subsequent inflammation that occurs in such cases must be diminished by fomentations and poultices, &c. and all irritating matter removed as soon as possible.

The same changes in the blood take place in fractures of bones, and in simple wounds of soft parts. In simple fractures, effused blood not being exposed to the influence of the air, retains longer its vitality, and is usually in a great degree consolidated, by which the union of the divided parts is promoted. Even when there is a larger effusion of blood, so that a portion remains fluid, it does not coagulate, but retains a portion of its vitality, and the neighbouring absorbents remove it; while the consolidated blood round the injured part takes on the reparative process by the inherent changes which take place in it. Mr. Hunter injected the arm of a man who died a month after it had been broken. He found that the cavity between the extremities of the bones was filled up with blood which had

* Bell's Principles of Surgery, new ed. by Sir C. Bell, vol. 3, p. 356.

" coagulated." This blood had become vascular; in some places it was very much so.

Wounds in arteries which form diffuse aneurisms are frequently very difficult to discriminate and to treat. In such cases, when there is evidence of a considerable artery having been wounded by a small instrument, or by a wound penetrating it in an oblique direction, extensive and irregular extravasation of blood occurs; the size of which, and the pressure it produces, is often followed by gangrene of the neighbouring parts. So that should the patient recover from the loss of blood, his life is still in danger from the suppuration and destruction of parts, and their consequences.

To prevent these primary and secondary effects of wounds in arteries of considerable size, the external wound should be enlarged; the coagulated and consolidated blood in the sac removed, the artery tied above and below the wounded part, and the external wound dressed as a simple sore ; or otherwise the vessel leading to the injured part is to be cut down upon in the most favourable situation and secured.

In all such wounds of arteries, however, the treatment should be varied according to the circumstances of each case, and in no injuries coming under the care of the surgeon is practical experience more required than in deciding on the treatment to be pursued. The following is an interesting case of this kind.

Case.—Wm. Walby, in falling, was wounded by a carpenter's crown-piece, which entered some inches on the inner side of the left leg, and passed upwards and backwards. A profuse hemorrhage followed the infliction of the wound. About an hour after the accident he was brought to St. Bartholomew's Hospital, when the hemorrhage had ceased, and a small wound with a hard swelling was found in the calf of the leg.

Rest, cathartics, with general and local bleeding, was the treatment pursued for several days, during which the tumour increased in size, became more tense, and was accompanied by local inflammation and severe fever.

The original wound having healed, a small puncture was made into a part of the swelling somewhat softer than the rest of its surface, but only. a few drops of blood flowed from the large cavity, which

was found under the muscles. He continued better for some days, and purulent matter mixed with blood continued to pass from the wound; and as it was supposed the bleeding might proceed from a wounded superficial vein, the opening was enlarged in order to stop it, as the man was much weakened. The enlargement of the wound produced faintness, but the bleeding ceased, and cold lotions were applied to the leg.

On the eleventh day after the accident a quantity of pus and blood flowed from the wound; about mid-day the hemorrhage returned, and became decidedly arterial; and from its copiousness at the time of the accident, and the great swelling in the leg taken in conjunction with the recent bleeding, it was supposed that a large vessel had been wounded. The patient was very much reduced in strength, and it became a question whether the vessel should be cut down upon and tied, or amputation of the limb performed. Before deciding on this, he was removed to the operating theatre, where he felt so faint that it was necessary to give him some wine. The depth of the wounded vessel, and the long dissection that would have been required among the clotted blood, which would, in his low state, have been borne with difficulty, seemed to indicate amputation as the only remedy, and this was accordingly performed above the knee.

When the limb was examined, a large cavity was found extending from the knee to within two inches of the ankle-joint, occupying the entire breadth of the limb, and separating the muscles of the calf from those immediately covering the tibia and fibula. This cavity was filled with a mass of recently clotted blood, mixed with fluid blood and matter. When the cavity was washed, it presented a red inflamed surface, covered with a smooth layer of coagulable lymph, with a portion of consolidated blood which adhered firmly to the posterior side of the tibia and interosseous ligament above its middle. When this was forcibly removed, it was found to be formed of dense fibrous matter, like that lining the cavity of an aneurism, and having an internal cavity about the size of a hazel-nut, which had a smooth surface. In the space with which the covering corresponded, the posterior tibial artery and vein were situated, and were found half divided by a transvere wound. The aperture in the artery had an oval figure, without any condensed blood above or below

the wound. The upper side of the wounded vein was shrunk and closed, and the lower contained a recent coagulum, which allowed the probe to pass along its internal cavity easily.

This complicated case was treated by Mr. Lawrence with that judicious and decided practice for which he is so remarkably distinguished, and which in this case most probably saved the patient's life. It is also an interesting example of the powerful influence of the vital change in the blood which I have named *consolidation*, in arresting hemorrhage. Coagulation alone could never have opposed such a powerful obstacle to the bleeding; which would, but from the peculiar situation, size, and complicated nature of the wound, have been arrested by the efforts of nature, and formed an incipient varicose aneurism. The disease was in fact formed by a communication between the branch of an artery and a vein taking place in the consolidated blood which lay between the two vessels.

Should the extravasated blood be formed over a larger artery, this may communicate a pulsation to the tumour, and, the blood remaining partly fluid, will have an exact resemblance to an aneurism, from which it can only be distinguished by the history of the case, the effect of pressure upon the artery above the tumour, the permanent nature of the swelling, &c. Such cases should not be interfered with until, by careful watching, their nature has been discovered; if only an extravasation of blood, the application of a poultice so as to soften the part will be all that is required should any pain or irritation occur; after this it is to be treated as an abscess.

Should the swelling be produced from the influx of blood from a wounded vessel of considerable size, the tumour will increase, and will require the application of a ligature above and below the wound in the vessel. Mr. Hunter in his interesting work on inflammation* mentions another form of extravasation of blood, which pulsates and which takes place under the scalp at the time of delivery. The pulsation here arises from that of the brain, as the sutures are still open. In such a case the surgeon should avoid interfering with the tumour, as it is sufficient in general to assist nature in the efforts to disperse the swelling by absorption.

The same accurate pathologist has related the case of extravasated blood consolidating in a serous sac. A man came into St. George's

* Vol. 1, p. 346.

Hospital with a hydrocele, for which he was tapped with a lancet. When the serum was evacuated, the testicle felt larger than usual, and in a month the tunica vaginalis was as much distended as before the operation. The radical cure was determined on; the tunica vaginalis was slit open, but the testicle being found enlarged was removed. Upon its body was found a coagulum of blood, resembling a leech in appearance, and in the angle between it and the epididymis was another smaller one; at some points it adhered to the testicle and epididymis, at others it was unattached. The anterior of the coagulum was firm, although it admitted of being separated; it was raised at one end, when fibres were plainly seen running between it and the testicle. The adhesions of the small coagulum were in many places still firm. This blood had been extravasated by the puncture made with the lancet in drawing off the water, and had fallen down upon the testicle where it coagulated (consolidated). Over the whole surface of the tunica vaginalis there were vessels filled with blood, and clots of extravasated blood in different parts.[*]

Wounds penetrating the *abdomen* sometimes heal without any untoward accident; from immediate adhesion taking place between the serous surface in contact round the edges of the wound, which prevents extravasation from the intestines. Even blood-vessels may be wounded, and the hemorrhage stopped from the close contact of the surrounding viscera, from the consolidation of blood collected around the wound, and the resistance of the neighbouring parts. The internal bleeding being thus arrested, the extravasation is slowly absorbed.

When the wound has included considerable vessels, the extravasation of blood from its quantity increases the tendency to inflammation which the wound produced. In such cases it is necessary to avoid interfering with the remedial means which nature sets up, and which in general so effectually prevent extravasation. The inflammation is next to be carefully repressed by general and topical bleeding, fomentations, rest, dry and spare diet, &c. After these symptoms have been thus diminished, it is necessary to observe the patient for many days after the injury, as it often happens that by the absorption of the coagulable lymph or more vital part of the

---

[*] Loc. cit. vol. 2, p. 508.

extravasated blood, the remainder, reduced in its vitality, dies, and acting as an irritating and foreign body, and the sac containing it being bounded by consolidated blood and lymph, suppurates, and nature promotes its expulsion externally. An interesting case of this kind is related by M. Petit Jan in his Essay on Extravasation of Blood in the Abdomen. * In such cases, while the inflammation is to be moderated in the usual manner, the efforts of nature to expel the contained and now highly irritating fluid are to be promoted. In all cases the recurrence of inflammation 6, 8, or 15 days after the occurrence of a wound indicates a collection of such changed blood. By an opening to evacute such matter there is no fear of internal hemorrhage being renewed, as the inflammation and adhesion of the parts will effectually have prevented this; and the evacuation of the fluid produces the most favourable change on the disease.

The rupture of the spleen from blows is a frequent occurrence, from the organ being often in a diseased and softened state in this country (India). The rupture of an abdominal aneurismal sac, or of the sac containing the fœtus in cases of extra-uterine pregnancy, produces fatal hemorrhage. In these cases more or less consolidated blood is found round the ruptured part. In the fatal cases this had proved insufficient to stop the bleeding. When the blood is in large quantity, and poured out quickly, it produces such irritation in the sac as to cause a copious secretion of serum; still the blood retains its vitality, and coagulates and reddens on being removed from the body, which sometimes retains its warmth for a considerable time after death, apparently from the quantity of the effused fluid, and from its being surrounded by vital organs, which have, in these cases, a bleached appearance.

The care with which nature has defended the important organs contained in the chest, prevents the occurrence of frequent injuries there; but when a vessel is wounded and an extravasation of blood takes place into the pleura, the hard unyielding external case, and the weak and compressible contents, with the proximity of the vessel to the heart, and the tendency to a vacuum in the chest during inspiration, render such cases peculiarly dangerous. In the natural

---

* Memoires de l'Acad. de Chirurgie, tom. 1, p. 180, and tom. 2, p. 65. See also the Essay of M. de Garengeot on the same subject, tom. 2, p. 81.

E

state the lungs fill completely the chest, but their yielding nature still permits blood to be evacuated into the pleura. To stop such dangerous hemorrhage the powers of the circulation are to be lowered, the bowels kept lax by neutral salts; and total quietude with avoidance of all heating and stimulating food, or much drink, is to be carefully observed. One of the most able professional men in this country in assisting a gentleman who had broken his leg by an accident, so as to have him conveyed home, ruptured a blood vessel in the chest. He returned home in his carriage, and most unfortunately visited some patients next day, which increased the bleeding, of which he died three days after. While as a friend I regret his lamented loss, it must be recollected that he has left a reputation for humanity and skill that will be long remembered in Calcutta, whilst his writings give him a professional name that will always command admiration and respect. After the first dangerous symptoms have been checked, others may follow resembling those of other large internal deposits of blood, which will probably require the evacuation of the fluid, as already explained under the head of effusions into the abdomen.

When an effusion of blood takes place in the substance of the brain, the immediate consequences will vary according to the quantity, the part into which it is effused, the constitution of the individual, &c. When considerable, it most frequently destroys the person, either in a short time, from the direct consequences of its pressure, or more tardily by the consolidation of the blood, and the inflammation which its presence as a foreign body produces. In other cases the interior of the clot, and sometimes large portions of the brain, are slowly changed into pus before the person dies. In some, from the small quantity and situation of the effusion, or from the strength of the constitution, a process of reparation commences. The effused blood consolidates, its centre becomes pale and soft, and at length fluid; the whole is finally contained in a sac, and becomes less red. This fluid is slowly absorbed, and the soft and jagged brain round the blood becomes paler and harder, the parietes of the cavity contract, and a pale greyish substance is left in its place. This is slowly removed, the cicatrix of the brain shrinking as cicatrices do in other parts. The brain for a long time around this part retains a yellow colour, like the effused

blood in the cellular tissue, as it disappears. In the treatment of all cases of apoplexy, it is of great importance to remove as much blood from the circulation in the first stage of the disease as will prevent further effusion ; by keeping the bowels open, applying cold to the raised head, wearing warm clothes, using oleaginous frictions, and avoiding every stimulus to the system, we do all that is immediately necessary ; we are however to be very careful to avoid every means liable to reduce the strength of the system too much, strength being now so necessary for promoting the salutary changes in effused blood, and the restoration of the brain to its healthy function. The continuance of the cause renders relapses frequent; and from the nature of the organ affected, these relapses are always dangerous, and their effects continue very different periods. The cure of this form of palsy is slow, and sensation is restored, first in the parts that are furthest from the brain. In some cases a peculiar numbness is only felt in a set of muscles, which are moved as in health. The loss of sensation and motion is more particularly evident in the viscera of the pelvis.

Effusion of blood may take place into the eye on the occurrence of acute ophthalmia. Mr. J. Bell has related an interesting case of such an effusion into the anterior chamber of the eye, so that the organ appeared half filled with blood. On taking violent exercise, or from any other cause occasioning an increased flow of blood towards the head, the attack was repeated, and at last became periodical, and occurred spontaneously.* In such a case strict regimen, free evacuations, a seton in the nape of the neck, and an abstemious, quiet, and regular course of life, so as to appease the sensibility of the eye, is required. In cases of abscesses in the lungs, liver, and other vascular parts, fatal hemorrhage is generally prevented by the large vessels having been rendered impervious to blood by the adhesive inflammation and consolidation of blood in the vessels, preceding the softening of the parts, and the formation of the abscess.

* Loc. Cit. vol. 3, page 349.

SECTION III.

Sthenic changes in Blood effused externally.

Blood effused from vessels and exposed to the air consolidates less firmly and completely, as part of the vital fluid effused, from exposure to the air, coagulates or dies.

It is of much consequence to the speedy reparation of an incised wound, to diminish as much as possible the exposure of the extra-vasated blood in a wound to the air, and thus avoid its coagulation. When this has occurred to a considerable degree, the treatment should consist in removing the recent coagulated blood, and thus preventing the irritation of this extraneous substance, and in bring-ing the surface of the consolidated portions of blood together, and there retaining them until the completion of their adhesion. This is the more readily accomplished, as the small effusion of blood into the vital cellular tissue and other neighbouring parts, for the most part consolidates closer the small vessels that may be divided, and connects the parts that are not much separated from each other or injured by violence.

When a superficial wound is inflicted, as the bleeding ceases a coagulated portion of blood is left upon the surface, in contact with the air, and another portion on the vital surface; the latter consolidates and becomes intimately connected by new vessels with the cut sur-face. Should the scab be torn off in this stage, it is found to con-sist of coagulated superficial blood, and an internal consolidated portion. In this the healing process is going on, and the intimate union becomes evident from its vascularity, and the blood is thin and florid, designating its arterial nature. Such an intimate union is explained by the effused consolidated blood retaining a certain portion of vitality, and being united with the living structure by numerous vessels, in which the new skin is formed. Should the scab be removed at a later period, the new skin is found covering the wound and defending it until its natural covering is sufficiently developed to protect the parts underneath.

In the treatment of recent incised wounds the coagulated blood on their surface should be removed by washing. The care with which blood is removed should depend on the strength of the individual

and the vitality of the parts, and in particular on the degree of its exposure to the air. When this has not been great, considerable portions of extravasated blood may be left in the wound with impunity, as it is slowly removed by absorption. The sides or lips being brought together, the opposite surfaces of the consolidated blood unite by the secretion of gelatinous coagulable lymph, and the union may be completed in from twenty-four to thirty hours. The consolidated blood in the wound becomes paler in colour, and is quickly organized by new vessels forming ; the superfluous consolidated blood is absorbed, and the effused lymph is gradually changed into what is called a cicatrix.

Such processes of reparation are performed by the local vitality of parts without the system participating in the action, unless the wound be extensive or the organ or part be important or sensible.

When large members are amputated, such a shock is given to the system as to repress the whole powers of life ; but, a short time afterwards, a state of a reaction in the parts succeeds, and then the vessels, which at the time of the operation had ceased to discharge blood, now commence to bleed. This being often in considerable quantity, is only partially consolidated, and the coagulated portion acting as an extraneous matter, increases the irritation, and often induces suppuration. To diminish as much as possible such a cause of irritation in the stump, it ought to be exposed for about half an hour to the air, when any bleeding vessel may be easily secured, and all the coagulated blood removed; the divided parts being then brought together, they are in the most favourable state for union, and there is little fear of hemorrhage.

Compound fractures may take place directly or consecutively. When the fracture of a bone has occurred with a wound which exposes it to the air, the solution of continuity is more complicated and dangerous, and the reparation of the injury is much slower than when the fracture is simple, in consequence of the lower vitality of the bone than the soft parts, and from the effused blood losing partially its vitality by exposure to the air, which increases the irritation, and hastens suppuration. In this case the solution of continuity is healed by the formation of granulations.

Should the effusion of blood be considerable in a simple fracture, or the injury to the soft parts extensive, a partial consolidation occurs near the vital tissue ; while the blood near the centre, and

where the soft parts are much injured, remains fluid. This produces great irritation, the inflammation passes to the suppurative stage, the simple becomes a consecutive compound fracture, and the reparation when it occurs is slowly completed by granulations.

When the lungs are so diseased that an increased quantity of blood is sent to a particular part by the impeded circulation in others, or when this effect is produced by diseases of the valves of the left side of the heart,—hemorrhage into the bronchi, and hæmoptysis may be produced, forming what is called apoplexy of the lungs. On dissection a coagulum, partly consolidated, is found, which is formed in part of the cellular tissue of the lungs.

The following case occurred to the celebrated M. Lænnec, and affords a beautiful example of the organization of blood effused upon a mucous membrane. A patient was brought to La Charité, Paris, in the last stage of phthisis pulmonalis; during the period he remained there, he had several attacks of hæmoptysis; and a short time before death several severe fits of coughing, which threatened suffocation. When the trachea was examined after death, it was found that where it bifurcates into the bronchi, an oval-shaped organized consolidated portion of blood was situated, about an inch and a half long, and four or five lines in diameter, which nearly filled up the left branch of the bronchi, adhered intimately to the mucous membrane, and had superficial vessels ramified on its surface.*

Several cases are on record of persons expectorating portions of flesh, which appear to have been portions of consolidated blood, which had formed, as in the above case, and had been detached during life by the violence of coughing.†

The great changes in the quantity and quality of the blood sent to the uterus, and the occasional consolidation of portions of it when effused upon its mucous surface, explains the formation of a variety of polypus, which occasionally occurs in that organ.

* This case is referred to his work De l'Auscultation Mediate. 2nd ed. tom. 1. p. 261.
† Act. Nat. Cur. v. V, obs. 74. Comm. Litterar. Norimb. 1745, p. 215.

Sthenic changes in the Blood in its natural receptacles.

We have seen that the vitality of the blood is soon destroyed on being exposed to the air, and less quickly when effused into vital tissues; we shall next consider the changes that occur in the blood while remaining in its natural receptacles, by sthenic causes.

All changes in the quantity and quality of the blood act on the vital tubes through which it passes. In youth, when the cruor is large in quantity, and the arterial system of vessels active, the blood performs the important offices of growth; in old age, a less active state of these vessels is required, and the cruor is found diminished in quantity, and the circulation is slower and less active.

In some cases the quantity and nourishing quality of the blood are so much increased in the adult beyond its natural condition, as to produce that state of the body called plethora; in which the pulse is strong and active, and there is a predisposition in the system to inflammation, which is exhibited by the local increase of the vitality in a part. For understanding the nature of the extensive and most important class of sthenic diseases, we shall trace the effects of irritation applied to the large vessels, which will enable us to explain the like changes in the smaller branches, the size of which renders the investigation more difficult, and less conclusive.

When two ligatures have been tied round a living vessel containing blood, so as to leave the interval of an inch between them, Hewson found that the blood in this isolated portion retained its vitality ten times longer than when removed from the body, and did not put on any appearance of buff. When a portion of blood belonging to another animal was introduced into such an isolated portion of a living vessel, coagulation took place slowly, and this was accelerated by dividing the nerves which supplied the isolated portion When the blood of another animal has been exposed to the air, and the vitality thus diminished, coagulation takes place more rapidly. The destruction of the nerves of the part, or whatever diminishes vitality, hastens coagulation.

This is not alone produced by the state of rest, as generally be-

lieved, or we should expect it to take place in hibernating animals, during long swoons, trances, &c. In such cases the blood in its low degree of vitality becomes darker, thicker, and seems half coagulated. When in this state it is exposed to a higher degree of temperature, and at the same time its motion is accelerated, it quickly increases in its fluidity and its vitality.

When coagulation has once taken place, the blood cannot be restored again to its homogeneous fluid state; but being dead putrifies, as other dead animal matter.

When the principal trunk of an artery of a member is tied, the circulation is slow in the collateral branches, but no coagulation takes place. These examples prove that something more is required for producing coagulation or consolidation than rest, and that something is a destruction, or an increase of vitality, beyond its natural degree. Hence, such consolidated portions of blood form in a conical figure, from the base being near the seat of irritation and the apex at a distance, which is consequently small and surrounded by the liquid blood. In like manner the conical figure forms in concentric layers. These changes may be considered :—

§ 1. *As they appear in Veins and in the Heart.*—The blood as it circulates may be locally diminished or increased in its vitality. We have seen that when diminished to a certain degree, it is no longer capable of supporting the body in its usual state, which becomes weak and emaciated from the diminution of the nourishment which is derived from it; and this vital fluid is sometimes found depraved so as to approach a state of putridity. When the vitality of the blood is augmented locally, there is an increased secretion, which contains a larger quantity of coagulable lymph, the pabulum of new parts. Should the exciting cause be applied to a large vein, after it has reached a certain degree of augmentation, the homogeneous blood changes to a solid state—or consolidates. When a large superficial vein is so irritated as to be inflamed, the first symptom indicating this state is a hard cord-like substance, which may be felt along its course, and is proved, on dissection, to be produced by a consolidation of its contents. This change in the blood is constant, and seems to be produced by an increased degree of that alteration which is observed when the system is strong; and is the effect of a higher and morbid state of vitality in an inflamed vein. In the same

manner the vital principle of the vessel and its contents act on each other, and produce the diversity of fluids in health and disease. The same sympathy between the vessel and its contents produces a reciprocal action on each other when either is affected with disease. Thus when an irritating cause is applied to a vein, it first affects the tissue, and then the contents, which again act on the vessel. It is irritation which produces a consolidation of blood in the vessel. On examining this change more carefully, we find that it takes place in those places in which the blood flows more slowly; which the increase of irritation to a certain degree produces, and thus resembles the slow circulation in secreting vessels, in which vital changes naturally take place. The consolidation in the vein first takes place in the centre of the column of blood, and as the influence of the irritation increases, new layers are deposited upon the first, and this goes on until the whole vessel is filled with the changed blood. In this state it possesses the property of inherent motion, becomes organized, and thus shows the visible effects of life.

It is the irritation which produces the red streak externally, and cord-like feel along the course of the inflamed vessel; and when the exciting cause is diminished or removed by the early application of antiphlogistic remedies, these symptoms disappear, the consolidated blood is again resolved into its fluid state, the vessel becomes pervious, and the parts are restored to their natural state. This forms the termination of phlebitis by resolution.

When the cause is more severe, or the system more susceptible, the inflammation continues and the vessel remains impervious, by the consolidated blood filling the vein; from the absorption of the serum in the cellular tissue round the vessel being retarded, an œdematous swelling is farther produced by its accumulation along the course of the diseased vessel. When the inflammation is more acute, a larger portion of coagulable lymph is secreted, and a hard swelling is the consequence, which often extends, not only along the course of the vessel, but also to the neighbouring parts, producing fever, and much distress to the sufferer. In such cases abscesses frequently form in the cellular tissue, and are discharged with much relief to the patient. This acute inflammation in the neighbourhood retards the progress of the phlebitis; which, however, frequently runs a fatal course by the extension of the inflammation along the vein.

The changes which take place in the vein, when not arrested by antiphlogistic remedies and the solution of the consolidated blood, are often not observable in consequence of the severe external inflammation, which, although distressing, is but of secondary consequence, when compared with the very dangerous effects of the inflammation in the vein.

The extent of the consolidated blood varies according to the powers of the system, the degree and length of application of the exciting causes, the size of the vessel, its distance from the large trunks of the heart, and the size and number of the collateral branches. When the inflamed branch is small, the consolidation seldom extends far, especially in the course of the circulating blood, and when the vessel has many valves, and enter a trunk at an acute angle.

The consolidated blood remains, for a time, unconnected with the tissue of the vessel, which appears quite healthy; but when the inflammation is more severe, the coats of the vessel participate, secrete lymph into their proper tissue, and upon their internal membrane, which lymph becomes thickened, and an intimate connection takes place between it and the consolidated blood. This forms the adhesive state of inflammation in veins.

The consolidated blood, we have seen, is formed by concentric layers; and when the inflammation continues, it undergoes other changes. The red globules become fewer at the centre, and at length disappear, leaving a hard white substance. This change advances externally, while the central portions soften, and are often converted into a puriform matter. The external crust remains longer red and unchanged, and being united to the internal surface of the vein, forms an irregular surface, which may be mistaken for a false membrane. In general, before death, the whole consolidated blood is changed into pus, leaving a shining irregular surface for a short distance below and a considerable distance above the seat of the part to which the irritation had been applied; and in this space the vessel is filled with pus. Should the person live long enough, the pus accumulates and tends outwards, forming separate abscesses, as often occurs. The accompanying drawings (Pl. I.) show these different changes; as in the three examples, the abscess is bounded by consolidated portions of blood adhering internally to the thick-

ened tissue of the vessel; and forming the adhesive stage of phlebitis. In this manner the progress of the disease towards vital organs is retarded, and the introduction of pus into the system is prevented.

In some cases, from the severity of the cause or weakness of the system, there is not a sufficient quantity of consolidated blood produced, to retard the progress of the disease in the vein; this occurred in the patient from whom the preparations figured were taken. In such cases fever ensues, which takes on a typhoid type, and soon terminates in death.

After enumerating the changes which take place in the blood when veins are actually inflamed, we shall now be prepared to consider the changes produced by a more chronic cause. When a vein is wounded, a portion of its contents are evacuated into the neighbouring cellular tissue, and unless the vessel and wound be large, the bleeding soon ceases. A portion of consolidated blood form between the lips of the wound, the inner surface of which is soon covered with a thin, smooth, transparent membrane of new formations similar to, and which becomes continuous with, the internal membrane of the vein. This consolidated blood changes into a whitish semi-transparent substance, or cicatrix, which differs from the proper tissue of the vein. When the vein has been divided across, it contracts and retracts within the cellular tissue, more or less of a consolidation of blood takes place in and around the cut extremity, which generally stops the hemorrhage that may occur from the anastamosing branches of veins, and the little propelling force of the circulation in this system of vessels. The vein becomes thus impervious, to the next collateral branch which pours the blood into it. The consolidated blood in the vessel near the divided surface slowly diminishes, becomes pale, and the vessel slowly obliterated in the dense cellular tissue surrounding it.

In other cases in which consolidation of blood takes place in veins, the circulation is carried on through the collateral branches, and the vessel becomes permanently impervious to blood. In such cases, the consolidated blood slowly changes to a hard pale substance; and, as it diminishes in size, the vessel shrinks, and is reduced to an impervious cord. In this manner the largest trunks of veins may be obliterated, without any bad consequences being produced. The vena cava was found obliterated, from the insertion of the emulgent

veins to the right auricle of the heart in cases described by Baillie,[*] Morgagni[†] and Albinus.[‡] In another case Albinus found the inferior vena cava and iliac veins obliterated by concretions, and in the body of another individual he found the left internal jugular vein contracted and obliterated by coagulated lymph.[§]

In some cases, from local irritation applied to trunks of veins and the heart, portions of consolidated blood are formed, the inherent vitality of which increases and they become organized by the formation of new vessels, which connect themselves with those of the tissue of the vein. Such organized portions of the blood are called polypi. From the continued motion of the blood in the vessel their formation is rare, and only occurs when the circulation is languid. I have frequently seen large veins filled with consolidated blood, which, on a careful examination, seemed to be organized, from the number of white lines running through the mass, and which, from the manner they ramified, appeared to be vessels. " I think," says the accurate John Hunter, " I have been able to inject what I suspected to be the beginning of a vascular formation in a ' coagulum,' when it could not derive any vessels from the surrounding parts." In other cases I have found old tumours of a red colour, and very vascular, firmly attached to the internal membrane, which appeared to give them a covering. These tumours seemed to have formed a considerable time before, and to have been produced by changes taking place in the condensed blood. Other cases are on record of such polypi being found in veins. I saw a beautiful specimen of this polypus, the size of a filbert, firmly adhering by its neck to the venæ portæ, as it entered the liver, in the Museum of the Civil Hospital at Vienna.

When a slight and temporary cause produces a portion of consolidated blood, and there are numerous collateral branches at the part, and the circulation is very languid, it often remains for a considerable time without any further change ; excepting the formation of a thin smooth transparent membrane on its surface, exactly like that of the internal membrane of veins. In other cases, the red globules are removed near the centre, and the pale substance left is hard, tough, and like cartilage. In this state it may remain a considerable

* Trans. of A. Soc. vol. 1. p. 129.   † Annot. Academ. lib. 7, c. 2.
‡ Epist. 36, art. 10.
§ Op. Path. p. 6, sect. 8.

time, as occurred in the case of a woman who died some time after delivery. On dissection the veins of the uterus were found large and tortuous, and the consolidated blood had, at several places, assumed a cartilaginous appearance. In another case the patient seemed to have lived longer after delivery, as the consolidation of blood had partly filled up the calibre of the vessels, in the interior of which calculi were found. These are produced by gradual changes in the consolidated blood to cartilaginous, and afterwards into osseous, substances, which have been called Phlebolites. Such changes may be frequently seen in different stages, up to the osseous state, in veins.

These phlebolites are found surrounded by, but unattached to, the vein, and the smaller ones often admit of the circulation of blood, and are surrounded by consolidated blood.

In some cases the consolidated blood which surrounded these calculi is removed, and the vessel being left impervious, shrinks, and in time becomes impervious, leaving the calculi in what is erroneously supposed to be cellular tissue. These phlebolites have an ovoid form, and are found of all sizes, from that of the head of a pin to that of a pea or bean, and have usually a smooth surface. These calculi are of a light yellowish colour, generally mixed with red externally. They are formed of concentric layers, their specific gravity is near that of bone, and their hardness increases when taken out of the body and dried. By chemical analysis they are found to consist principally of the phosphate and carbonate of lime, united with animal matter; and there is likewise a trace of the presence of phosphoric acid, &c.

These calculi are most frequently found in the pelvic veins, especially in those ramified on the rectum, the neck of the bladder, and uterus; from these veins being more subject to inflammation, the slow course of their contents, their being subject to great changes in size, and to their frequent communications, which allow the circulation to be carried on by the collateral branches. As these veins are less liable to the acute causes of phlebitis, when the constitution is weak, and the inflammation chronic, the blood is thus allowed slowly to be converted into cartilage and bone. Phlebolites, however, are not peculiar to the pelvic veins, as they are frequently found of the largest size, and of a more irregular figure, in the veins

of the spleen.   They are not unfrequently found in the branches of
the external pudic.   Cruvelhier has seen them in the veins which
accompany the anterior and posterior tibial arteries ; and in a patient
who died of phlebitis, I found a calculus the size of a pin's head,
surrounded by a portion of consolidated blood, and lined with smooth
membrane, in one of the communicating branches of veins at the
bend of the arm.

Phlebolites are found in general from 2 or 3 to 20 or 30 in number ;
in one case I counted 40 in the veins which surrounded the prostate
gland and neck of the bladder.

Consolidation of Blood in the Heart.

As the occurrence of polypi in the heart has not always been
allowed, from portions of coagulated blood attached to the irregular-
ities of its internal surface, formed after death, having been mistaken
for such polypi, a few remarks will be required on this subject.

As the heart does not completely empty itself at each contraction,
portions of the blood may consolidate, when predisposed to do so,
by a sthenic condition, or by a local state of the organ.   From the
force with which the blood is propelled, we may expect that these
polypi will occur when there is an impaired action of the organ in
that part which is more particularly out of the course of the cir-
culation, when they will assume an ovoid form.   Polypi then
form slowly, by the deposit of concentric layers of consolidated blood
upon their surface, and their presence is in some cases not even
suspected during life.

Mr. A. Burns[*] found, in a heart in which the right auricle and
ventricle were considerably dilated, a large and fully organized
pendulous polypus lodged in the former, which hung down into the
right ventricle.   It was so firmly attached by a rough surface to the
musculi pectinati, as to allow the whole mass of the heart and a
considerable portion of the lungs to be suspended by it.   Its structure
was dense, lamellated, and no red globule seemed to enter into its
composition.

Mr. J. Stewart[†] has also described a case of polypus of the

* Diseases of the Heart, p. 197.
† Edin. Med. and Surg. Journal for 1817.

heart, which was highly vascular. There was one in the right auricle, and one in each ventricle.

In another case Mr. Burns found a polypus, more then one inch long, so firmly attached to the septum of the heart, that the lining membrane of the ventricle was torn before the polypus could be separated from its attachment. Where the two were in contact, the septum was painted with small red vessels. In the centre of this polypus an abscess was found, which discharged about a teaspoonful of perfectly formed purulent matter.

Mr. Wardrop has seen the preparation of a polypus of the left ventricle, in the centre of which was a distinct abscess.[*]

In other cases these consolidated portions of blood are more rugged, and resemble those in aneurisms, and sometimes contain deposits of osseous matter.[†]

Cruwell found a small globular body, principally composed of cartilage and bone, and containing a cavity in its interior, wedged in between the valves of the pulmonary artery.[‡]

The symptoms of these polypi resemble much, and are often confounded with, diseases of the valves of the heart. In the primary stage the symptoms are first those of inflammation of the heart, which are succeeded by symptoms of obstructed circulation, such as oppression and anxiety at the upper and fore part of the thorax, occasional rigors, and profuse perspirations, accompanied with dyspnœa, particularly on taking smart exercise. The pulse is at times irregular, and generally frequent, cough with expectoration, at times streaked with blood. In other cases after an attack of oppression at the heart, there is severe dyspnœa, great listlessness, and inability to remain in the horizontal position, followed by expectoration of considerable quantities of florid blood.

The above remarks on the consolidation of blood will enable us to explain the plan of treatment to be pursued, not only to relieve the distressing symptoms, but also to enable nature to remove the polypus. Such a plan will be strictly antiphlogistic, such as bleeding, a spare and dry diet, purgatives, rest, and digitalis. By these

* Baillie's Works, vol. 2, p. 20.
† A. Burns on the Diseases of the Heart, &c. p. 202.
‡ De cordis et vasorum osteogenesi in quatrogenario observata. Halæ, 1765.

means the distressing symptoms may be relieved, the consolidated blood arrested in its formation, and what had been formed may be removed, when treated in its primary stage.

§ 2. *Consolidation of blood in arteries.*—Arteries are more highly organized and their contents possess a greater degree of vitality, than veins. In the one case lymph is more freely effused when the vessel is irritated, and in the other, blood is more liable to be consolidated when inflamed, from the diminished velocity with which it circulates through veins. It is only when the impetus of the blood is retarded or stopped in arteries, as by a ligature, that its disposition to consolidate has an opportunity of displaying itself.

Hemorrhage is retarded in a wound which has divided an artery by the contraction and retraction of the vessel into its sheath. In uterine hemorrhage the mouths of the large vessels, left open after the separation of the placenta, contract to a small size, by the rapid reduction of the organ now emptied of its contents. In these cases hemorrhage is stopped by the closing of the open extremities of the vessels; but this alone is not sufficient to stop the impetus of the blood in divided arteries in other parts of the body, where nature employs various means to assist in arresting the bleeding. By the retraction of the vessel within its cellular covering, a portion of blood is arrested and consolidated in the irregular sheath, which diminished the opening in the vessel; when the external wound is not large, and the branch small, it is followed by the consolidation of blood betwixt the lips of the wound, a stop being thus put to its further evacuation. In a large proportion of such cases artificial means must be employed to diminish the open aperture in the vessel, which, from the low state of organization in arteries, does not heal by the usual process of adhesive inflammation. Should the wound in the artery be of considerable size, or even small, the impetus of the circulation is so great, and the wound in the vessel so callous, that hemorrhage may recur many days after it had been stopped, by the want of firmness and consequent vitality in the consolidated blood betwixt the lips of the wound. This will take place in the same sized vessel less readily in proportion to the strength of the system, and the degree of local irritation. When the system is affected with acute inflammatory fever, blood is less liable to be consolidated than in health, from the increased propelling force of the heart, and more

fluid state of the blood, although in a higher state of vitality. In such cases the blood insinuates itself further along the capillaries, when their action is so weak and the course of the blood so slow, as frequently to be followed by a consolidation of the blood there: this consolidation being succeeded by the usual symptoms of inflammation. Should there be any local irritation in large trunks, where the circulation is accelerated, it may be overcome by the disposition to consolidation, by which the vessel is obliterated. Thus in stumps the irritation which the application of the ligature to the vessel produces, and the stagnant state of the blood in the part, explain its speedy consolidation. The blood of weak persons consolidates imperfectly, but on the contrary coagulates or dies sooner. Messrs. Hewson and Hunter supposed the weaker the action of vessels the sooner the blood coagulated; which they contended was proved by making an incision into the femoral artery of a dog, when there were no signs of coagulation found, while the blood flowed rapidly; but as the action of the vessels was weakened it became evident. When a person dies from hemorrhage following the wound of a large arterial trunk, a small portion of blood will be found filling up the wound in the vessel; this portion having coagulated at the time of death. The consolidation of blood cannot be depended on for closing the wound when the artery is of a considerable size, in consequence of the impetus of the blood in the vessel. A ligature should, if possible, be applied above and below the wound, as the simplest and most effectual means of arresting such an hemorrhage.

The internal membrane of arteries rarely inflames spontaneously, owing to its office; but when irritated by mechanical causes, it readily undergoes adhesive inflammation. Dr. Jones* found that the effusion of lymph, from a wound made in the internal and middle coats of an artery by a ligature, was sometimes enough to obstruct it even when the ligature was immediately removed. In other cases three or four were applied at a short distance from each other, so as to produce a sufficient secretion of lymph to cause the obstruction in the vessel. He gives a figure representing the carotid artery, which had thus been obstructed by the momentary application of

* On Hemorrhage. Lond. 1805, chap. 3.

F

four ligatures; and it affords a beautiful example of the effects of strong irritation applied to the artery of a horse two days before it was killed. In that part of the vessel upon which the four ligatures had been applied, coagulated lymph adhered to the internal surface of the artery, so as to form but one substance with it; completely filling up its canal, even projecting a little beyond the points of adhesion, and intermixing above and below with the fluid vital blood. " This coagulation filled up the artery for some distance above and below the lymph, but did not adhere to the internal membrane of the vessel." * Such is Dr. Jones's explanation.

It would appear that the irritation was so severe as to produce a secretion of lymph from the wound in the internal and middle coats of the artery, and a consolidation of the blood which extends above and below the part. Where the ligatures had been applied, the consolidated blood had changed to a hard white substance, from the inflamed state of the coats of the artery at that part; and above and below it remained in its state of recent consolidation. This success led Dr. Jones to conjecture that in some surgical cases the ligature might be removed at once, the middle and internal coats having been divided. But there are two circumstances that militate against this conclusion. 1st. The impetus of the blood in arteries preventing the formation of consolidated blood, there is danger of the operation not succeeding; 2ndly. Hemorrhage is more liable to occur in the human subject than in the horse, as the arteries of the former are less subject to the necessary degree of inflammation, and the blood to consolidation. On this account temporary ligature has not been found to answer; as the presence of the thread is not only necessary to arrest the impetus of blood, but also, in most cases, to keep up a certain amount of irritation.† When a ligature had been applied for an hour or two, Mr. Travers found the vessel blocked up with lymph, mingled with coagula of blood.‡ It requires from 10 to 24 or 48 hours according to the constitution of the person, &c. to complete the consolidation

* Loc. Cit. pp. 128 and 229.

† Mr. Dalrymple's Experiments, as stated by Mr. Travers in his interesting Essay on the Ligature of Arteries, tend to this conclusion.—Med. Chirurg. Trans. vol. 4. p. 442.

‡ Loc. Cit. vol. 6. p. 633.

of the blood in the vessel; a few hours will not be sufficient to obliterate the artery. Removing the ligature at this period, as Mr. Travers and Scarpa recommend, would be attended with danger, from the tissue of the vessel being softened by its state of inflammation, and so made liable to give way. Mr. A. C. Hutchison applied a double ligature to the femoral artery for a popliteal aneurism. The ligatures were tied with loops, or slip knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and they were untied and removed, without the slightest disturbance of the vessel. In less than half a minute afterwards, the aneurism became distended with blood, and the pulsations were as strong in the tumour as before the operation. Two fresh ligatures were applied, hemorrhage afterwards came on, amputation was performed, and the patient died.* By allowing the ligature to remain until removed by ulceration, which will be completed in 8, 15, or 20 days, this danger is much diminished. If the artery be small, its organization is higher, and the ligature is discharged by ulceration about the fifth or sixth day.

When a living vessel is tied with a ligature, the internal and middle coats are divided; but the kind of cut will vary with the size of the ligature employed. A large or flat ligature makes a bruised and lacerated wound, which is more disposed to take on the suppurative and ulcerative inflammation than the adhesive form; this tendency is increased by the greater irritation which the larger size of the ligature produces.† When the artery is healthy, a small ligature that will make an incised cut in the internal coats, and cause little irritation by its presence, is to be preferred, but in a weak person in whom the artery possesses a low degree of vitality, and is extensively ossified, a flat ligature may be preferable. By thus drawing the ligature less tightly together, so as to avoid the irregular division of the small plates of bone, a necessary increase to the irritation is produced, by which the adhesive inflammation will be

* Pract. Obs. in Surgery, p. 102.

† See Mr. Lawrence's excellent practical Remarks in Med. Chirurg. Trans. vol. 8. p 490.

promoted, and the tendency to secondary hemorrhage prevented.
In a man fifty-nine years of age, bleeding took place nearly a month
after amputation from the ossified femoral artery; and Mr. Law-
rence, was, therefore, obliged to expose and tie the vessel again for
the suppression of the hemorrhage, when he found a hard tube,
which cracked immediately that the ligature was tightened: the
bleeding, however, did not return.* In this case the slow progress
of adhesion, after the former operation, was not sufficient to prevent
hemorrhage; but it assisted in producing the necessary degree of in-
flammation, which in such patients is promoted by a large ligature
brought less tightly together, and by increasing the irritation so as
to ensure the necessary adhesive inflammation, without much splin-
tering of the tube of bone.

When a ligature has been applied to an artery, the union of the
opposite sides takes place through the medium of the secreted coag-
ulated lymph from its wounded surfaces, and consolidated blood from
the irritation in the part. This adheres at its base by the effused
lymph to the internal coat of the vessel, and beyond the point it re-
mains unattached, and of a conical figure, as it extends from the
part irritated. In proportion to the extent and firmness of the consoli-
dated blood, will the fear of secondary hemorrhage be diminished.
By the irritation of the ligature on the coats of the vessel, and its
contents, the blood consolidates round the divided coats of the ar-
tery ; and as the irritation continues, new layers are deposited upon
the consolidated portion, until a pyramidal form is given to it, from
the diminished irritation, as consolidated blood forms at a greater
distance from the irritating cause, when it is surrounded by liquid
blood. Such changes are locally produced in the blood by an in-
crease in its vitality, as has been already stated; after being in-
creased to a certain degree, it changes to a uniform solid mass in
concentric layers, of a dark red colour externally, and becomes pale
and harder towards its centre. These vital changes are produced
by an effect exactly opposite to that of coagulation, or the chemical
changes in the principles of the blood.

By this consolidation of blood, a firm barrier is formed to the ex-
travasation of blood; strengthened by the lymph which the irritated
coat of the artery had thrown out, uniting its divided sides, and the

* Loc. Cit. vol. 6. p. 193.

base of the consolidated pyramid of blood. As the irritation of the ligature continues, the inflammation passes to the ulcerative form, by which it is separated, and thrown off without fear of hemorrhage.

In some cases, from the weakness of the general system, or vessel, the necessary adhesive inflammation may not take place. Such local weakness may be produced by its external coat having been dissected from the neighbouring parts, by the rugged nature of the wound in the internal coat of the artery, by the presence of a large sized ligature, and such a degree of inflammation ensuing, as passes to the ulcerative stage, before a sufficient quantity of lymph and consolidated blood is formed, to resist the force of the circulating blood; in this way what is called secondary hemorrhage succeeds. This may be caused by the ligature having been applied to the trunk of the artery, near the point where a large branch joins it. For this reason the ligature should be placed round an artery at some distance from such a branch, so as to allow the secretion of lymph and a column of quiescent blood to assist in the formation of the consolidated portion, without being disturbed by the flow of blood near it. The distance to which the consolidated blood extends after the application of a ligature round the trunk of an artery, will depend upon the constitution of the person, the degree and extent of irritation produced, the number, size, and acute angle at which the blood flows through the collateral branches, and distance from the heart. Hence it is more extensive in the trunk, and on the side of the ligature next the heart. The great additional security thus obtained by placing the ligature at some distance from considerable branches, is exemplified in the case related by Mr. Travers,* in which a ligature had been placed upon the external iliac, between the epigastric and circumflex iliac arteries. The ligature was in contact with the former at the angle which it makes at its origin from the iliac. There ulceration took place, and a fatal hemorrhage ensued. No "coagulum" was found in the iliac trunk, although the operation had been performed several days before ; the circulation through the epigastric had continued. The artery was impervious, and united by lymph at the seat of the ligature.

The general vitality of the blood, and its local increase by the

---

* Loc. Cit. p. 656.

irritation of the ligature, causes lymph to be secreted into the tissue of the vessel, and on its internal surface, which firmly unites the consolidated blood to the vessel and thus prevents hemorrhage. The discovery of an irritant, which would produce such a degree of inflammation in an artery, as to ensure the consolidation of its contents, is a point of much importance, and one which I do not despair of seeing soon found out; as it would in many cases prevent the necessity of having recourse to the knife, and the danger attending an operation to secure the artery by means of the ligature. Pressure has sometimes been employed for this purpose, and when applied locally for a considerable time over an artery so as to retard the blood, and irritate the vessel, it has succeeded. But, as this method is tedious, uncertain, and painful, it is very rarely employed by British surgeons. By rest, antiphlogistic remedies, and pressure applied to the artery which feeds an aneurism, and an irritating substance applied to the sac, the impetus of the blood may be diminished, consolidation promoted in the sac, and the cure accomplished.

As the irritation which produces consolidation in the blood diminishes, other vital alterations take place in it. Where the irritation had been severe, the coagulum changes to a pale tough substance, and the union with the vessel is intimate; beyond this the blood retains its firm red homogeneous appearance; but when longitudinally divided, the pale hard appearance in the interior is found extending farther from the irritated part. The consolidated blood becomes reduced in size but still retains its figure, has a hard fibro-cartilaginous appearance, is firmly united to the vessel, and is more or less vascular. As the inflammation disappears, the consolidation of the blood diminishes, and the vessels may again become pervious by an aperture being left in the remains of the consolidated blood. This change is of practical importance, as it proves the necessity of retaining the ligature until ulceration has thrown it off, when it is required to effect the permanent closure of the vessel; when this is not necessary, the removal of the ligature before ulceration may admit of the continuance of a partial circulation in the vessel.

In some cases the blood is so completely diverted from the vessel, that the consolidated blood, after slowly diminishing, may at last be completely removed, and the vessel thus left open; as in the cases described by Professor Thomson in his excellent lectures on

inflammation.* In a case of aneurism cured by an operation, the patient died two years after, from the bursting of an aneurism of the aorta. The femoral artery was found obliterated from the profunda to the sac of the aneurism; and consolidated blood was seen adhering at several points to the coats of the artery, and on the surface of the clot some fine vessels were observed ramifying.

In other cases a complete obliteration in the vessel is not required. When there is much blood in a semi-consolidated state in an aneurismal sac, it is of consequence to tie a ligature round the trunk of the artery, at some distance from the sac, in order to stop the impetus of blood and permit consolidation in the sac, while a small quantity of vital blood is still allowed to pass, and which prevent its contents from coagulating, and causing dangerous irritation. In like manner the operation proposed by Dessault, and performed by Brasdor and Mr. Wardrop, of securing the artery beyond (distad) the aneurism at some distance from the sac, in order to allow a small quantity of blood to enter it, and even to admit of branches enlarging between the sac and the ligature. In all such cases, previous depletion will assist in preventing the bad effects of the impetus of the blood in the sac. The following case proves that a complete stop to the circulation in the artery is not required for curing an aneurism. Mr. Soden tied the iliac artery for an aneurism of the femoral artery; the patient was cured, but about two years after he died suddenly of aneurism of the aorta. On examining the thigh, the aneurismal sac, though very small, was still pervious; as the circulation had gone on through the artery.†

The means by which nature removes sphacelated parts without the occurrence of hemorrhage, is explained by the surrounding contiguous parts being always affected with inflammation before the death of the part. As this inflammation is of an adhesive nature, coagulable lymph is thrown out into the interstices of the cellular tissue, and a consolidation of blood in the living portions of the arteries and veins takes place; which, on the separation of the dead from the living part by ulceration, prevents any bleeding occurring. These effects of irritation extend to different distances beyond the sphacelated part, according to the vitality of the tissue, the strength

* Loc. Cit. p. 556.
† See Shaw's Manual of Anatomy.

of the individual, or the degree of the irritating cause.   It not unfre-
quently happens that no hemorrhage occurs when amputation is
performed at some distance above the division of the dead from
the living parts.   Mr. O'Halloran removed a limb at the distance of
four inches above the sphacelated part, and no bleeding occurred.
M. Petit appears to have been the first who noticed this remark-
able fact.   " When a gangrened limb," says that celebrated surgeon,
" is cut off in the dead part, no hemorrhage occurs, because the blood
is coagulated for a great way in the vessels.   The clot is white and
firm, and consists of coagulable lymph; as seems proved by the
following observations.   Mr. Martial, Surgeon-Major of the hospital
at Fournay, in 1694, cut off the leg of a poor woman affected with
gangrene, in the part which was dead.   No hemorrhage followed
amputation of the first leg; nor would it in the second, had not the
surgeon, after cutting off the limb, pulled out from the extremity
of the artery a round, firm, and white clot, about three inches in
length.   The column of blood had pushed it a little forward, for it
projected seven or eight lines from the vessel.   The canal of the
artery being no longer shut up, blood flowed into it, but was stopped
in the usual way."[*]   We have several examples on record of limbs
amputated on account of gangrene, in which no hemorrhage occurred,
although the operation was performed a considerable way into the
living parts; because the clot was not confined in these cases to the
dead part, but was continued forward into the living, as far as the
inflammatory disposition extended.   The accurate Hunter supposed
that a disposition to " coagulate" is given to the blood by the inflamed
state of the vessels; and thus he accounts for the coagulation in the
artery of a mortified limb.   Hemorrhage being thus prevented, the
purposes for which these consolidated portions of blood were formed
are accomplished; the inflammation slowly diminishes in the part,
and the consolidated blood shrinks in size.   The changes which take
place in the consolidated blood have been already stated, and its
altering to a white appearance explains the manner in which vessels
are afterwards found filled with what has been supposed to be
coagulable lymph.

From the force with which blood flows through arteries, it conso-

[*] Memoirs of the Royal Academy for the year 1732, as referred to in Thom-
son's Lectures, p. 553.

lidates when a ligature or wound has been made in them, or when the vessel has been irritated in a certain degree. When this impulse of the blood has been diminished in the cavity of an aneurism, the irritation of the diseased part enables nature to strengthen the sac by the formation of layers of consolidated blood. When this irritation is considerable, the layers may be deposited in such quantities as to fill up the diseased sac, and thus the cure of the aneurism may be accomplished. Cases of this kind have been related by Corvisart[*] and by Hodgson.[†] The experience of these able pathologists proves that aneurism in the trunks of arteries may be cured by the formation of consolidated blood, which leaves the vessels pervious. When this natural cure of an aneurism takes place in a branch, the higher organization of its tunics is the cause of the vessel being usually filled up with consolidated blood for some distance beyond the aneurism.[‡] In general, however, while the consolidated layers of blood strengthen the cavity of an aneurism in one part, the force of the blood prevents the efforts of nature from strengthening the whole sac, by a sufficient deposit of consolidated blood.

* Essai sur les Maladies du Cœur, p. 313.

† Diseases of Arteries, &c. French Translation, p. 157.

‡ By the formation of consolidated blood in the sac a spontaneous cure of the aneurism may be obtained. Mr. Blagden, surgeon at Petworth, was consulted by a man of about fifty years of age, tall and muscular, who had his humeral artery wounded in opening the basalic vein. The blood was stopped at the time by strong compression. An ecchymosis extended itself generally from the shoulder to the wrist; an aneurismal tumour formed, and at six months it had increased to the size of a cricket ball, hard, with a strong pulsation in it. The arm was oppressed, cold, shrunk, pulseless, and, as the patient expressed it, painfully lifeless. As the tumour seemed to be diminishing, Mr. Blagden ordered the arm to be rubbed with a flesh brush, and the patient to refrain from all exertion. The arm grew warmer, a sensible tremulous pulse began at the wrist, the tumour gradually diminished, and the strength of the pulse at the wrist increased. In eight or ten months, the tumour in the bend of the arm was reduced to the size of a hazel-nut, while the pulse at the wrist was quite restored, and the arm full and fleshy, and as capable of powerful exertion as the sound one.—J. Bell's Principles of Surgery, vol. 4. p. 441, new edition.

M. Petit has related a case of aneurism in the right carotid artery in which a spontaneous cure was obtained. (Acad. Royale des Sciences de Paris, an. 1765.) Dessault dissected a similar case in which a spontaneous cure had taken place in a popliteal aneurism, with an obliteration of the trunk of the artery.—Journal de Medecine de Paris, tom. 71. p. 431.

Where the irritation is too great for the adhesive termination, ulceration is the consequence ; a gangrenous spot forms, and on its separation a fatal hemorrhage occurs.

When the sacs of such aneurisms are examined, the consolidated blood lining their cavity is found in layers which had been deposited at different times, and consequently differ in colour and consistence. One layer is found to be consolidated blood in its more recent state, another is pale and hard, and a third has the appearance of cartilage. Not unfrequently this is partially changed to bone, generally of an irregular figure, and imbedded in the changed consolidated blood. Such varieties are produced by the gradual vital changes in the consolidated blood.

When the aneurismal sac is near the heart, less blood is propelled through it ; and on dissection in such cases, the aneurismal sac is often found empty, its walls thickened, and the surface smooth and shining.

In some cases the aneurismal sac may be so large, and the patient's constitution so weak, that the blood coagulates in its cavity, and irritates it as a foreign body ; while from the irritation so produced, the blood of the artery which feeds it consolidates and fills up the vessel. The sac suppurates, and the coagulated and consolidated blood it had contained is thrown off. In this manner a permanent cure may be accomplished ; but in a large proportion of such cases, the irritation in the sac destroys the person, weakened by previous disease.

A portion of blood may coagulate in a large sac when the trunk of the artery has been tied with a ligature, for curing an aneurism. This acting as a foreign body produces such a degree of irritation as to inflame it, and extending to the artery, which feeds it, produces a consolidation of blood which fills up the vessel. The aneurism swells, becomes very painful, and red ; with a considerable degree of symptomatic fever. When opened, broken down coagula of blood, mixed with pus, are evacuated, with much relief to the patient's sufferings, and produce a diminution of the symptomatic fever. On this account the aneurismal tumour when large, or the person weak, should be carefully watched for a considerable time after the artery has been tied ; and as soon as it is discovered that much irritation is present in the sac, it should be opened, and its contents evacuated.

When inflammation of the aneurismal sac takes place spontaneously, a radical cure may be accomplished by its obliteration and that of the vessel.   In a large proportion of such cases, however, the person weakened by the distressing disease is destroyed by the severity of the symptomatic fever which the local irritation produces.

In the same manner the largest trunks of arteries may be obliterated, by local irritation consolidating their contents.   It is only when the vessel is so diseased, and the disposition of the part to inflammation is considerable, that such effects are produced; in general the impetus of the blood prevents such changes.   In peculiarly favourable circumstances, consolidation of blood may occur in large arterial trunks near the heart.   Dr. Graham states that in Messrs. Pattison and Russel's Museum there is a preparation where the aorta is plugged up by a laminated "coagulum," just above the bifurcation of the iliacs, into both of which this substance extends?[*] Stenzel,[†] Meckel,[‡] and Stoerk[§] have related other cases of such obstructions being found in the aorta.

Dr. Baillie found two solid tumours situated in the carotid arteries; the cavities of which were completely filled with coagulated (consolidated) blood; which adhered firmly to the inside of the vessels, and consisted of distinct layers, like that in the sac of an aneurism.[||]

I shall conclude these remarks by a few practical observations on applying ligatures to arteries.

1st.—Ligatures to arteries ought to be applied at some distance from the point at which a large branch unites with the trunk.

2nd.—The artery should be as little disturbed in its natural situation as possible while securing it.

3rd.—The ligatures to be used should vary in size and figure. In the young and strong, when a small branch is to be secured, a fine ligature should be chosen.   In the old and infirm, when the vessel is of a large size, and expected to be found ossified, a flat ligature is to be preferred ; which is to be tied with less force than

[*] Med. Chirurg. Transactions, vol. 5. p. 297.
[†] Dissertation De Steatomatibus Aorta.
[‡] Mem. de l'Acad. R. de Berlin, 1756.
[§] Med. Chirurg. Transactions, vol. 5. p. 287.
[||] Trans. of the Soc. for the Imp. of Med. and Surg. Knowledge, vol. 1. p. 191.

usual, so as to avoid dividing the brittle deposit of bone, and the consequently too rapid ulceration and sloughing of the irritated part.

4th.—One ligature is sufficient, and it should be allowed to remain until removed by the ulcerative process.

5th.—When the aneurismal sac inflames, producing fever, &c. it ought to be opened early, and its suppurating contents evacuated.

6th.—When secondary hemorrhage occurs, the artery should, if possible, be secured at some distance, nearer the heart, from the bleeding part; and where the vessel is in a more natural and healthy state, adhesive inflammation will more readily take place.

CONSOLIDATION OF BLOOD IN CAPILLARIES.

Capillary vessels, or the minute terminations of arteries and the commencement of veins, are more slender than hairs, and can only be examined with the assistance of the microscope; by which they appear soft, thin, and transparent. As the force with which the blood is sent from the heart is nearly spent before it reaches these slender terminations, it is assisted in its course by their elasticity and irritability, as it slowly flows through their numerous divisions and anastomosing branches. This minute stream stimulates the capillary vessels to contraction, and thus assists the circulation; and the blood coming into close contact with the parietes of the vessels, where it is more under the nervous influence, its contents undergo important vital changes. When these capillary vessels are irritated by the direct application of local stimulants, such as heat, or through the nervous system, as in blushing, a determination of blood to the part follows. By this beautiful resource of nature the action of one part of the capillaries may be increased, without affecting the general circulation, and it is by this action on certain classes of capillaries that many remedies act so beneficially in removing diseases. Such an effect is often owing to the determination of blood to a part, and the consequent increase of its functions, as is exemplified in the action of diuretics, &c.

The difficulty and importance of distinguishing the proximate cause of the symptoms produced by a considerable irritation applied

to a series of these minute vessels, has induced me to consider the sense in which the word proximate ought to be used ; the reasons for supposing a consolidation of blood to be the proximate cause of inflammation ; and the manner in which it explains its symptoms and terminations.

I. *The proximate cause of Inflammation.*—In medical works the word cause is so ambiguous, that many mistakes have been made in its meaning, and some explanation of the term may here be offered. In the present work it is merely used to designate the law of nature of which the phenomenon considered is an instance, or a necessary consequence. It is the province of the physiologist to analyze the connections and dependences of the different parts, and the laws of their several movements, according to which, the efficient causes operate. The consideration of these laws do not properly belong to the physiologist, but to the metaphysician. By disease is meant an assemblage of preternatural symptoms, or irregularity, difficulty, or pain in any functions of an organ ; and as these have a sympathy with others, which may be weak, or predisposed to derangement, it is necessary to separate these two sets of symptoms before we can distinguish the proximate cause of the disease. The difficulty of doing so is increased by the rapidity with which these complicated symptoms appear after the proximate cause, and the modifications to which they are individually liable. In some cases ophthalmia produces no effect upon the system, but in others fever occurs ; and in some the brain and nervous systems are affected. In this case the local inflammation acted as a proximate cause in producing fever and the affection of the head. Hence our first object, unless in cases where other very urgent symptoms are present, is to attack the proximate cause of the primary affection. Thus in dentition from the inflamed state of the gums, a tissue which is not very sensible in health, we have often nervous symptomatic fever, pain, and derangement of the bowels, convulsions, &c., produced by the irritation. When the gums are freely divided at an early stage of the irritation, the other symptoms disappear; but, if allowed to go on for some time, the secondary becomes a primary affection. In consequence of this complicated nature of disease, a proximate cause is said not to be admissible in strict pathological reasoning ; still, in a practical point of view, it is of great importance to distinguish it, as there is inva-

riably a circumstance or cause for the occurrence of other symptoms in every disease, which, if removed, the type and force of the disease is broken. Inflammatory diseases always exhibit certain symptoms, and are followed by effects, which are modified by individual circumstances, such as the tissue affected, &c. That primary and invariable cause, which is always followed by the symptoms of inflammation, which can always be produced by certain causes, deserves to be called its proximate cause; or that cause which when present produces the characteristic symptoms, and which when removed is followed by their disappearance.

The proximate cause of inflammation will be found in the smaller vessels as they are principally, and often solely, affected; which is at first confined to one spot, from which it gradually extends to the neighbouring parts. The extent to which such vessels are affected will vary with the cause and constitution, &c. of the person. This local action of inflammation is proved by more blood being sent to the part, by the hardness and throbbing of the artery supplying the affected part. Thus, when a finger is affected with whitlow, the radial artery feels firmer and harder than the artery of the opposite side. In like manner, from repeated examination, I find that the blood removed from the neighbourhood of a highly inflamed part contains more crassamentum, of a firmer consistence, than that removed from a distant part of the body; and when the system is affected, produces symptomatic fever, when a like change is found to have taken place in the general mass of the blood, as indicated by the appearance of the buffy coat.

By such an irritation applied to the fibres of the vessels affected, they act on their contents, the blood becomes of a more florid colour, and of a more fluid consistence, so that the homogeneous blood is propelled onwards with more force, and the red part conveyed further, and in great quantities, along the minute arteries of the part; which, acting on the vitality of the blood, produces a consolidation of the contents of the vessels affected.

When this increased local vitality of the blood is considerable, or when the part is highly sensible, the heart and general vascular system participate in the increased local action; and the degree of severity of this constitutional effect will vary with the extent, degree, and susceptibility of the system, and of the part affected, its

importance to the economy, its nature, and the constitution of the person. Thus the finger may be inflamed without the system participating; but if the sensible part of the nail be so affected, symptomatic fever is produced. In these cases the general effect is caused by a higher susceptibility of the part.

II. *Facts in favour of the opinion that consolidation of blood in capillary vessels is the proximate cause of Inflammation.*—As I have already traced the effects of irritation in large vessels, and from the above remarks on the functions of those of a small size, in which morbid changes are examined with greater difficulty, I shall now consider the reasons which lead me to believe that the effect of severe irritation on capillaries is the same as that produced in large vessels; there being only a difference in the two classes of vessels, from varieties in these vital functions, and the slowness of the circulation, and number of anastomosing branches which render capillaries more liable to have their contents consolidated than the trunk of vessels. Such a similarity of effect by the application of irritants will be more readily allowed, when it is considered that the anastomosing extremities which form capillaries are the continuation of the small arteries and veins; from which they receive and evacuate the same fluid, after it has performed its important offices in these vessels.

The vital powers of capillaries may thus be locally raised or lowered according to the state of the circulation, while the consistence of the blood remains nearly the same. When still more increased, it assumes new characters, and is no longer the action of health, but of disease. In the first case, there is only a congestion of blood; in the second, the blood consolidates, as we have already seen it do when so irritated in the trunks of vessels.

When the irritation applied to a part is severe, and its effects are observed with a microscope, it is found that the arteries, capillaries, and veins of the part enlarge, the blood becomes apparently more dense, flows slower than natural, and at the part where irritation is most severe, stops altogether. The anastomosing branches of the part enlarge, and become apparently more numerous, so that many of them now convey red blood, which, in their natural state, distributed the colourless part. In these collateral branches the circulation is carried on more quickly, and more blood is sent to the part than in

the natural state. The foregoing are the result of observati
made with the solar microscope. Those of other enquirers
equally favourable to what must be considered a theory; a t
most generally employed in medical writings as one of repro;
but in all philosophical enquiries the term theory should be m
properly considered as a systematical arrangement of facts in a 1
sonable order, for their explanation. It was my intention to (
ploy the term in this sense; and in order to avoid as much as ;
sible the bias of my own peculiar opinion, I shall record,
preference, those of authors who are well known in medical lite
ture.

"It constantly happened," says Dr. Hastings, "that when
flammation commenced, no globules would be seen" with the
croscope "even in the blood of the affected vessels. It was uni\
sally converted into a bright homogeneous fluid. So that globi
can never be seen in the capillaries of a really inflamed part, m
less moving with great velocity."*   "How different," says Dr. V
son Philip, "would have been Mr. Hunter's inferences, if, inst
of trusting to the unassisted eye, he had viewed the inflamed ves;
through the microscope. He would then have seen the bl{
moving; and found, that, instead of its passage being quickened
the inflamed vessels, it is uniformly rendered slower, in proportion
the degree of inflammation; and in the most inflamed parts, it sta;
still altogether."†   A late and very accurate enquirer says—"As
blood stagnates in the vessels of the most inflamed part, it gradu;
concretes into irregular masses, in which the distinction of the g
bules is no longer perceptible.   These changes are seen to go
in animals dying, while inflammation exists, even after all moveme
of blood in other capillaries has ceased."‡

The minute size of the capillary vessels renders it difficult
detect their exact state on dissection, when slightly inflamed; b
when the inflammation is great, the large capillary vessels, parti
larly the veins, are found filled with consolidated blood, and exter
ing to the larger branches. This fact is well known to practi

* On Inflammation, &c. p. 98.
† On the Vital Functions, p. 276.
‡ Kalkbrunner in Magendie's Journal for 1828, referred to by Alison in
Outlines, p. 431.

anatomists, who find it impossible to fill the enlarged capillaries of inflamed parts with injection, though these vessels in their natural state admit it freely. Such inflamed parts are found red after death, and the small branches more numerous and distended than in their healthy state, with more or less thickening, &c. of the part. These appearances are explained by the vital change which had taken place in the inflamed vessels; by which the blood had become an uniform solid red mass; which, unlike the appearance from congestion, is not changeable by washing or other mechanical means, without destroying the vessels in which the blood is contained.

III. *Manner in which consolidation of the blood, as the proximate cause, explains the symptoms and termination of Inflammation.*— The symptoms produced by the application of a certain degree of irritation to capillary vessels, are their increased action, redness, and some degree of tension and swelling.

1. The arteries of an inflamed part are increased in their action, and augmented in their size. This produces a redness by the congestion of blood in the vessels of the part, so that small branches, which naturally only admitted transparent fluid, now allow a passage to the red globules, which give the red colour to the part. A well marked example of this is seen in inflammation of the tunica conjunctiva of the eye. Should this increased quantity of blood in a part circulate slowly, and the consolidation take place principally in veins, the colour will be less florid. When the inflammation is acute, and the circulation quicker through the collateral branches, less proportionate changes take place from the florid to the purple colour, from the congestion of blood occurring principally in the smaller arteries, and passing to the veins, without undergoing the usual change; for the same reason, the colour is florid towards the centre of a phlegmon, and less so towards its circumference. This is known by the increased flow of more florid blood, when an inflamed part is divided; and has been improperly supposed to be a proof of a relative and absolute debility of the part; this mechanical obstruction, however, is produced by the state of the vessels, and their contents.

2. Heat of inflamed parts. In consequence of the greater action of the arteries of inflamed parts, from their increased vitality, changes take place in their vital properties: the part becomes of a

G

higher temperature, which varies with the quantity of blood, and
the rapidity with which it is circulated in the part. This increased
heat does not appear to be so high as the sensation would lead us to
suppose, or above that of the blood near the heart (viz. about 99•);
and it is rarely so high, as the blood is affected in its passage
through the vessels by the temperature of the surrounding tissues.
It is by the increased velocity, the quantity of blood sent to the part,
and the state of the nerves, that the increased sensation of heat is
produced; it follows the increased vitality of the part, which would
diminish, did the blood remain stagnant in the inflamed part.

3. Another consequence of the increased action of the capillary
arteries of an inflamed part is, to produce pain. This is caused by
the distended vessels pressing upon the nervous filaments of the part,
which are also more sensible than in their natural state ; so that
ordinary impressions do not convey distinct but painful sensations,
which are greater in proportion to the degree of the excitement,
and the suddenness with which the capillary vessels were enlarged;
which prevents them from accommodating themselves to the change.
Hence pain is more severe in parts naturally endowed with little
sensibility; as the teeth, fibrous tissue, &c. The pain, therefore,
in inflamed parts varies in the nature and intensity of the inflam-
mation, according to the rapidity of its invasion, its degree, extent,
and kind, and the tissue affected; being always greater in the sensi-
ble capillary vessels than in the larger branches.

When the part is sensible, and the inflammation acute, with
large arteries in the neighbourhood, or when the part is pressed or
stretched by the increased secretion, or the tissue affected is of an
unyielding nature, it conveys the pulsation of the enlarged arteries,
and produces the throbbing pain which indicates active inflammatory
action in the part; as in whitlow, when the heart's action is little
increased. On this account pain is not felt at first, but as the vessels
enlarge, pulsation becomes evident, and then pain is severe. For the
same reason it is mostly felt at the centre of the inflamed part, and
diminishes towards its circumference.

In acute phlegmonous inflammation, when the parts have free
liberty to swell, the sensibility is not much increased, and the
pain is pungent.

When the inflammation attacks particular tissues, the pain may

be acute, and sharp; which is produced by the stretching of muscular fibres and membranes. When the pain is obtuse and burning, there are few muscular fibres in the part affected; as occurs in inflammation of the lungs, &c. A burning pain is likewise felt when the inflammation is more diffuse, as in erysipelas.

In some rare cases, however, there is little or no pain felt, as sometimes occurs in inflammation of the pleura. This latent inflammation usually occurs in persons exhausted by fever, after severe injuries, by the great discharge which occurs; and is explained by the absence of nervous sensibility, which is not naturally acute in such parts.

The redness, heat, and pain, vary in degree and intensity so much in different cases, as to indicate that they are not essential to inflammation. Experience proves the correctness of this supposition, as they all appear in certain cases of congestion; and the reason is found to be the absence of the proximate cause—the consolidation of blood in the vessels. When this has taken place, sudden changes of position of the inflamed part no longer occur; and the symptoms are more permanent, and are confined to a smaller circumscribed spot. Where, therefore, with the redness, heat, and pain, consolidation has taken place in the capillary vessels, the effects are concentrated and permanent, and are followed by other symptoms—which prove the presence of such consolidated blood, and consequently of inflammation.

4. Tumefaction. For explaining the occurrence of swelling in inflamed parts, it must be recollected that some vessels are employed for the nourishment of parts, others for secretion. The functions of both these classes of vessels are deranged when inflamed. The consolidated blood accumulates in the capillary vessels where they are less under the influence of the increased action of the heart, than in capillary arteries which act more strongly from their increased vital state, and to overcome the obstruction which the consolidation of blood forms to its progress. This augments the quantity, and modifies the quality, of the secretion into the cellular tissue, on which the corresponding arteries are distributed, for the purpose of moistening and lubricating the surface. This change in the secretion, like that in its tissue, is produced by a higher state of the vital properties, and organic actions of capillary vessels. When the con-

G 2

stitution is strong, the part vascular, and the cause acute, a large proportion of lymph is secreted, from the increased vitality in the part, and consolidates, uniting the surfaces upon which it is secreted, and becomes organized. When these vital changes are not carried to too great an extent, they increase the size of the part ; and when to such a degree as to pass this point, so as to become morbid, they circumscribe local diseases, by the effusion of coagulable lymph into the cellular tissue around them.

When less acute, or when the individual is weak, more serum is secreted, as in the first stage of erysipelas, or phlegmonous inflammation, when the swelling has at first a soft yielding feel, from the augmented secretion into the cellular tissue, which becomes of a harder consistence as the vitality of the deposit is increased. When less acute, the serum which naturally lubricates the part is increased in quantity from the diminished absorption, and from the want of coagulation, it feels soft, and is more or less diffuse. The degree of the swelling varies with the constitution, the cause, and the tissue affected; which will vary with the natural action of the vessels in the part. When the cellular tissue is loose, the accumulation of fluid will be considerable, and unless the inflammation be acute, the swelling will be general at the most depending part, forming œdema, when more extensive, it will constitute proper dropsy.

When a serous membrane is the part inflamed, a large quantity of serum is effused, and the inflamed vessels are disgorged of a considerable quantity of their contents, by which the inflammatory secretion is diminished, and floccula of lymph are found in the fluid effused; this constitutes hydrothorax after pleuritis, ascites after peritonitis, hydrocele after external injuries, followed by inflammation of the tunica vaginalis testis, &c. In all these cases less serum and more lymph is effused, according to the severity of the inflammation, and when this is long continued and severe, pus is secreted in the part.

In some cases blood is effused into inflamed parts, as from the villous coat of the intestines, and towards the fatal termination of inflammation in the lungs. This variety is produced by the vessels being imperfectly supported by the neighbouring parts, and yielding to the force with which the blood is sent to the parts on the proximal side of the consolidated blood, where the tissue of the vessel is softened and consequently much weakened.

When such a consolidation of blood has taken place in the capillary vessels of a part, the circulation is impeded; and from being accompanied with an increased vital state of the part, the action of the vessels is increased, when meeting with an obstruction, and being stimulated in the usual manner, the arteries throb more powerfully to rid themselves of their contents, while the collateral capillary vessels, which are not so affected, enlarge to carry on the circulation in the part.

This state of morbidly increased vitality explains the pain, and appearance of redness and heat, in inflamed parts; while the swelling is produced from the extremities of the arteries being more directly influenced by the action of the heart, and the increased vital properties of the arteries; by which their secretion is increased, and contains more coagulable lymph than natural, while the absorbents remain in a state of torpor. Inflammation would, therefore, appear to be a vital effect, although most of its characteristic symptoms are produced by mechanical obstruction in the vessels, followed by an accumulation of blood which produces increased heat and throbbing in parts, with the other local symptoms. Inflammation may be defined, therefore, such an increased vital action of the functions of the circulating system in a part, as may be necessary for its restoration or preservation; which increased action proceeds to such a degree, as to become morbid, by the consolidation of blood in the vessels principally affected. The different symptoms of the disease are only degrees of the same effect. If the skin be taken for an example, we may observe—

(1.) An increased and morbid vitality, or organic sensibility;

(2.) Redness of the part, with pain and heat; which continues for a short time, when the cause is slight, and has been applied momentarily;

(3.) A consolidation of blood, and

(4.) A secretion of coagulable lymph from the vessels which remain pervious, which, with the increased quantity of blood, produces the swelling in the part; such morbid changes producing the redness, heat, pain, and swelling. An increased secretion of the natural fluid into the part which, like the blood, becomes of a thicker consistence from the presence of an increased quantity of the coagulating matter. The lymph consolidates into false mem-

branes, which remain under the influence of the vital forces;
and as the local irritation diminishes, the solid deposit undergoes
various changes, blood-vessels appear in it, and it changes to the
characteristic structure of the tissue in which it is secreted.

When the irritation is greater, the fluid secreted becomes pus;
which, although it is changed, and even removed by the vital tissue
which surrounds it, acts as an extraneous fluid. Or should the sys-
tem be weak, or inflammation extensive, or the deposit considerable,
the secretion into the cellular tissue is less fluid, and of a caseous
appearance. This may often be seen in extensive phlegmonous in-
flammation, which terminates in partial suppuration, or in the de-
struction or death of the part.

These phenomena may be always produced, and increased to
any degree, by varying the strength and kind of the irritation ap-
plied, but are modified by the tissue, and peculiar circumstances
of the individual case. The regularity with which they may be
produced, is peculiar to inflammation, and is explained by its being
an increased development of the phenomena characterizing or-
ganization, no longer, according to Hunter, " a salutary effort of na-
ture," but a diseased action. It would appear, therefore, that the
more vital tissues of capillary vessels are first affected in inflamma-
tion; but from the increased vital action of the arteries, and the
rapid circulation in them, the capillary veins, in which the blood
flows much slower, are more extensively impeded by consolidated
blood. In some cases, particularly when produced by an internal
cause, the obstruction extends to the larger branches, which I have
seen in some cases extensively affected. It is from this cause that
veins are principally affected in inflammation, and that it more fre-
quently occurs in depending parts, where the vascularity is less, and
the circulation is easily impeded; while parts near the centre of the
circulation do not so often develop this peculiar state; and when
so affected, they more readily take on the most healthy form of
inflammation; unless indeed when important organs are attacked
and their diseased state affects the general health.

According to the above opinion, the remote cause of the healthy
form of inflammation may be considered such an increase of the
vitality in a part, so as to produce the proximate cause or consoli-
dation of blood, which is followed by the symptoms that characterize
inflammation.

CHAPTER IV.

TERMINATIONS OF SIMPLE INFLAMMATION.

When a strong individual is attacked with local inflammation, the symptoms, after an uncertain period, sometimes decline and disappear, without any unusual evacuation. This occurs from the consolidated blood being again restored to its usual fluid state, and the vessels of the part absorbing what had been effused, and then assuming their natural offices. This forms the termination called *resolution*. In many cases this result takes place after an increased secretion from the affected vessels, and as a consequence of blood having been removed locally, or from the general system, or of the employment of other antiphlogistic remedies.

§ 2. ADHESIVE INFLAMMATION is often the most favourable termination that can occur, as it separates dead from living parts, prevents the introduction of noxious fluids into the system, such as pus, &c.

When a serous surface inflames, the natural secretion is first augmented in quantity, and by an increased deposit of coagulable lymph false membranes are formed. This coagulable lymph is generally found uniting the two parts of the inflamed membrane that are in contact with each other; so that the spreading of the inflammation and suppuration, and the introduction of morbid secretions into the system are prevented. When first secreted, the lymph is soft, but becomes denser by and by, forms a bond of union between the parts in contact, and is organized by the formation of new vessels. This M. Beclard supposed he proved by thrusting at hazard an injecting pipe containing mercury into a false membrane; a set of arborescent canals were injected, the trunk of which was in the centre of the adhesion, and the branches, like the vena-portarum, distributed on opposite sides.*

When simple incised wounds are healed by adhesion, the cut vessels contract and retract into the cellular tissue. The effused blood coagulates, and in part condenses, filling up the divided ves-

* Anat. Gen. p. 195.

sels; inflammation is produced in the part by the irritation of the injury, which is followed by an increased action in the arteries, and secretion of lymph, and this, with the consolidated blood, unites the cut surfaces, while the coagulated portion forms a scab, that separates when the wound is cicatrized.

A more intimate knowledge of the laws which regulate this process has improved considerably the science of modern surgery ; but the best means of attaining the adhesion of parts, is a point of the greatest practical importance, and one in which there is still a considerable difference of opinion among surgeons. The result of some careful examinations led me to believe that adhesion is best attained by removing the blood, so as to leave but little of the coagulated portion, as the process by which it is changed and converted into the cicatrix is slower than the union which takes place by the effusion of coagulable lymph. On this account, after all portions of consolidated blood have been removed by cleansing the wound, it should be exposed to the air for an hour or two ; being then brought together, the determination of blood to the part, and the secretion of glutinous lymph, powerfully promote the union. The sides of the wound, in such cases, are to be supported and retained in contact by sufficiently long strips of adhesive plaster and bandages. In a large proportion of cases, this method of cure is preferable to the use of the needle and ligature ; as the less the circulation is increased in a part the better, beyond what nature employs for procuring the adhesion of the part.

Should coagulated blood be allowed to remain in a wound, it acts as an extraneous substance; if in small quantities, it may be removed by the neighbouring living parts ; but in large quantities, when the system is weak, it putrifies, and the irritation it produces prevents union.

When the wound has been produced by a blunt instrument, so that a part is much bruised and lacerated, and its vital force thus diminished, the consolidation of blood will be in small measure, and what is effused will be more liable to die. Such causes of irritation produce a considerable degree of inflammation, which is followed by purulent secretions.

In some cases of great weakness, or when there has been extensive laceration of soft parts, wounds do not adhere though brought

together; this is from the powers of life being so low as not to admit of the increased action, or slight inflammation, now indicated by the increased and modified secretion necessary to produce union taking place.

This want of aptitude to unite will likewise be modified by the tissue affected. Canals having external openings rarely adhere when inflamed; inflammation there usually terminates by the effusion of an increased quantity and modified quality of the secretion of the part; when more severe, the inflammation produces softening and ulceration in the tissue. This difference in the adhesive disposition of different tissues may in some cases be taken advantage of in the healing of wounds, more particularly those of the intestines. In the 5th vol. of the Transactions of the Medical Society, Calcutta, a short paper is inserted (p. 145) on this subject. In that essay I remark that as inflamed serous membranes quickly secrete coagulable lymph so as to connect them to the neighbouring parts, we may in this way explain the manner in which the intestines are often wounded and healed without any bad consequence, by the adhesion of the serous surface round the wound to that in contact with it. By this means extravasation of the contents of the gut, and its fatal consequences, are prevented. The same adhesion has occurred when the thorax has been wounded, so as to prevent extravasation into the cavity of the sac of the pleura. "I made," says John Hunter, "an opening between the ribs into the chest of a dog, and touched the edges of the wound all round with caustic to prevent it healing by the first intention. The dog died on the eleventh day after the opening; and I found the collapsed lungs passing directly across the chest, and attached to the inside of the wound all round, so that they excluded the cavity of the chest from all external communication."* In introsusception, the same adhesive process takes place between the true serous surfaces of the gut, at the commencement of the included portion, which may be removed by a slow ulceration at the part where the enclosing joins the included portion. In wounds of the intestines the treatment must vary with their size. When small, the wounded part may be returned into the abdomen, but when the gut is distended with liquid, and the patient weak, so that the ad-

---

* On the Blood, vol. 2. p. 59.

hesive inflammation is slow in developing itself, the part is to be
taken up by a pair of forceps, and the wound encircled by a firm cat-
gut ligature, which is to be drawn tight so as to divide the mucous
membrane and muscular coat of the included part. The ends of
the ligature are then to be cut off close to the knot, and the gut re-
turned. I have seen this practice followed with success in a case
of strangulated hernia, in which a wound was made, on the distended
upper part of the intestine, by the director. In this case the
wounded part was returned without any bad effects following. A
knowledge of this method may enable us, in some cases, to reduce
portions of strangulated intestine, as in the following case :—

. A young man was gored by a wild bull, and a ragged wound,
about three inches long, was made a short distance above the ante-
rior and superior spinous process of the ilium. It was in an ob-
lique direction, and penetrated into the abdomen. For three days
nothing seemed to have been done for this unfortunate person,
until he was brought to the station from a great distance. When
I saw him he was rapidly sinking ; his pulse imperceptible at the
wrist; his extremities cold; his countenance haggard, and ex-
pressing a degree of indescribable misery, the largest proportion of
the small intestines considerably distended with air, and tightly bound
by the thick margin of the wound, hanging from his abdomen. The
individual was young, and his constitution good, and as the only chance
of saving his life, I endeavoured to return the protruding intestines
as soon as possible. The upper part of the protruded intestine was
much distended, and covered with a dirty yellowish coloured fibrine,
which had united the convolutions; when these were separated
from each other, the surface of the intestine was of a deep
red colour, and at different distances small portions of light
yellowish granular-looking matter appeared, which seemed to be the
progress of the inflammation in these parts to suppuration. The
convolutions underneath were of a red colour, less distended with
air, and apparently had descended at a later period. Having enlarged
the wound with a probe-pointed bistoury, I endeavoured to return
the intestines into the abdomen ; but found great difficulty in doing
so, owing to their mass, and the fear of injuring a surface so inflamed,
and a tissue so very soft, and easily torn. In this case expedition
was necessary, and the only means of gaining this object was by

making a small oblique aperture at the lower part of the distended gut, when a large quantity of dark coloured fluid and air escaped; and then the whole intestines were returned without difficulty.

This case proved fatal from the state of exhaustion to which the person was reduced by the extent and severity of the injury; but I believe the practice was that which was best adapted to the circumstances of the case; and, as in the present instance, I did not consider the application of the ligature necessary when the gut had been emptied; it was in such a state of inflammation, that adhesion would immediately occur so as to prevent effusion. When the wound is extensive in an intestine, the serous edges are to be brought together and retained so by means of sutures. When dark mortified looking spots are seen, the gut is to be returned, as the inflammation round these spots will ensure adhesion, and prevent extravasation.

Union not only takes place between the divided surfaces of parts, but, in general, tissues have so much vitality that surfaces belonging to different parts of the body, when recently divided and brought together, adhere. Mr. Hunter has recorded several curious cases of this kind in which the spurs of cocks, the teeth of animals, &c. were engrafted into different parts of the bodies of other animals, and grew in their new situation. The same union is found to take place in the human subject; so that the cut surface of the arm, or any other part of the body, if retained for a certain time in contact with the scarified surface of another part of the body, unites. This principle has been advantageously employed for covering an exposed part of the surface which had been removed by disease. In such cases a portion of healthy skin and subcutaneous tissue is dissected, and only left adhering at one point to the part, and then applied to the place to be covered, after its surface has been scarified. The skin of the nose destroyed by disease may thus be covered again with healthy skin detached from the forehead or arm. In like manner teeth have been transplanted, with success, from one jaw to another.

Adhesion, which is so remarkably useful in many cases, may be productive of great inconvenience by uniting parts that are accidentally in contact with each other. In cases of burns near joints, much care is required to prevent the union of the inflamed parts brought near each other, and the contraction which is produced by cicatri-

zation. Frightful deformities are often seen among the natives
of India from an ignorance of this principle.

The contraction in wounds and formation of new skin, takes place
from the circumference of the sore when healthy, and when less so
from one or more points towards its centre.   When new skin covers
the whole of the wound it is said to be cicatrized; in which state
it is paler, smoother, and has less vital energy ; for which reason it
is more liable to be again affected with disease.

The formation of callus presents a more complicated process of
reparation than that of soft parts; and appears to be an additional
effort of nature to produce bone beyond that of healing wounds
made in soft parts.

By the violence which fractures a bone, numerous blood-vessels
are torn, and an effusion of blood takes place around its extremities,
and into the interstices of the surrounding cellular membrane and
muscles.   This blood consolidates, if the quantity be not great, and
the individual strong, and surrounds the broken extremities of the
bone.   The irritation which such an injury produces, causes a
determination of blood to the part ; the muscles and cellular sub-
stance become redder than usual, and the periosteum thicker and
more vascular.   This congestion is accompanied with an effusion of
coagulable lymph, or of a gelatinous looking substance, which forms
granulations ; these become continuous with others, formed by the
internal periosteum and extremities of the bones, and with the con-
solidated blood.   When these deposits are torn off, they peel in
layers which are thickly interlaced with vessels, and exhibit a fibrous
appearance.

Such changes were well marked in the case of a boy who died of
pleuritis, 22 days after a fracture of the humerus.   The periosteum
was easily separated from the callus, which was left rough, and per-
forated with holes for the passage of the torn vessels, which passed
from the periosteum to the recently deposited bone.   When traced
to the broken extremity, the periosteum was thickened and softened,
and at length terminated in a cartilaginous substance, mixed with
spiculi of bone, when it could no longer be traced.

The consolidated blood around the fractured bone becomes quickly
changed from a red homogeneous mass to a pale-coloured dense
fibrine, which unites with the lymph secreted by the periosteum,

and forms a mass which becomes like cartilage mixed with gelatine in appearance. This is the nucleus in which bone is secreted ; which depends on the degree of vascularity in the tissue of the part. The periosteum being the most vascular part engaged, bone is deposited in the largest quantity into the secretion upon its surface, and advances until it meets that formed on the other broken extremities. The internal periosteum likewise deposits bone, which extends slowly outwards, while the consolidated blood, which filled up the space between the broken extremities, is soon changed into a cartilaginous substance, in which ossification also takes place. The cure is completed when the broken extremities of the bone have been united, by the union of this callus, which is larger than the original bone, as it protrudes and extends inwards, until it forms a solid osseous mass.

Should the constitution of the individual who has received the injury be very weak, or the fracture comminuted, and the parts lacerated extensively, a considerable effusion of blood takes place, which is often only partially condensed. This is likewise the case when the subsequent inflammation is too severe for the formation of consolidated lymph. In this case a secretion of serum follows from the neighbouring parts, when adhesion has taken place ; which serum mixing with the fluid blood, forms a dark liquid, surrounded with irregular portions of it consolidated, of a dense consistence, and fibrous appearance. In such cases the bone, instead of being encompassed with a vascular lining of lymph, is reduced to an irregular serrated surface. We may expect to find such an appearance when a fluid is detected near the fracture, about a fortnight after the accident, without much previous inflammation. This fluid is slowly mixed with pus, of a more or less healthy nature, according to the circumstances of the case. When this has been discharged, the cure is accomplished by the process of granulation.

§ 3. SUPPURATION. When the symptoms of inflammation continue beyond those which form adhesion ; the consolidated blood in the vessels, and the secretion into the cellular tissue, change their appearance at the most inflamed part. Small spots become of a pale yellowish colour, soften, and are changed into minute collections of pus, which unite as the intervening tissue softens, and is removed by absorption ; by which it approaches the skin. By this ulcerative process, the disorganized part is thrown off in the same way as a

sphacelated part is removed from the system with the purulent
secretion.

An abscess when formed is found bounded by the cellular tissue
beyond the inflamed part taking on the adhesive inflammation; in
this state the coagulable lymph of the secreting arteries circum-
scribes the cavity, and a vascular sac of coagulable lymph is formed,
which is covered with a false membrane in which the pus is contained,
and in which absorption and secretion are very energetic.   The part
which was the centre of the inflammation is thus filled with pus, which
externally becomes soft and prominent.   When the inflammation in
a part has been severe and more diffuse, absorption occurs around
rather than in the part most inflamed.   The vessels of the part are
closed up with consolidated blood, beyond which absorption occurs,
separating the dead part or core, which is more or less reduced in
size before being discharged with the pus.

Suppuration in a considerable organ is indicated by the throbbing
sensation produced in the part, with coldness or shivering, succeeded
by a dry heat of the skin, and quickness and hardness of the pulse.
These rigors recur at irregular periods, and after the secretion of pus
the swelling, hardness, and throbbing of the part decrease, and the
febrile state diminishes.   This mitigation of the symptoms is par-
ticularly evident, when the inflammatory symptoms have been
most severe.

As capillary vessels are the seat of inflammation, so suppuration
occurs either from their diseased action in the cellular tissue, or
secreting surfaces, or indeed any tissue into the formation of which
they enter.   In such cases the secreting arteries, instead of throwing
out serum, as in health, or serum and lymph, when in a high state of
action, now secrete a modified kind which forms pus.

The circumstances which hasten suppuration are the degree and
nature of the cause producing inflammation: wounds, the lips of
which are not closed; a bruised wound preventing adhesion; when
parts have been so lacerated that their vitality is destroyed, and
must be removed in the same manner as a foreign body that is in
a wound before adhesion takes place.   In other cases the unhealthy
constitution of the person, or a critical abscess, towards the termi-
nation of some dangerous diseases, often promotes suppuration.

The tissue affected has an influence in producing suppuration,

When a mucous membrane is affected with a certain degree of inflammation, it secretes purulent matter. Cellular and serous tissues, when inflamed, are more likely to effuse serum; but when chronic, the fluid thrown out may be purulent.

In non-secreting parts suppuration is more apt to occur quickly when the inflammation is acute, than when chronic; when a part is near the heart, than at a distance from it; in children, than in adults, and in the adult than in the aged. Glands require longer time to suppurate than any other organ inflamed in a like degree. In the lungs, tubercles are the product of a certain degree of specific inflammation, by which they are softened, and terminate in purulent collections. Tendons do not seem to admit of suppuration.

When an abscess is opened in an early stage, it is found to contain a mixture of serum, coagulable lymph, and some purulent matter; and the abscess is said not to be ripe. In such cases the proportion of these ingredients will depend on the weakness of the part, the constitution, and the stage at which the abscess is opened. The following case is an example of an abscess in a weakly child, who received a hurt at the extremity of the thumb, which inflamed, and suppurated:—A little pus was seen under the skin, with diminished redness around it, and the following day the secretion was much increased, but from the lessened inflammation, was found to be principally serum. Had this patient been strong, serum would have been secreted first into the cellular substance, and as the inflammation advanced, would have terminated in suppuration, until the reproductive process had removed all the diseased appearances. These symptoms are explained by appearances which may be always observed on an external surface that is secreting pus. When this is removed by a fine sponge, it will be found that a serous fluid is first secreted, and, according to Sir E. Home, the globules are formed while it lies upon the surface, requiring in some instances fifteen minutes for its conversion into pus, which is then modified by the vital act that produces it, more particularly in its degree and nature. When the body is strong, or inflammation intense, the serous secretion quickly changes into pus; but, when the system is weak and the inflammation sub-acute, the pus is thinner, and is said to be less healthy. These appearances are well marked when a serous sac is inflamed; at first the natural secretion is increased, and contains

only floccula of lymph, but if more intense, the secretion becomes purulent.

It appears to be a law in the animal economy, not only that the vessels secrete their fluids by the vital act, but also that the vitality of the part acts in bringing the secretion to a state of maturity. This is the only way, I conceive, that we can explain the manner in which the different parts of the body are built up, peculiar secretions formed, and injuries restored. In infancy the tissues are in an imperfect state of development; by the extremities of arteries the peculiar fluids are secreted, which, by the vitality of the parts, are changed into their respective tissues, in the same manner as the peculiar secretions are formed, which differ so widely from the circulating fluids. It is in the same manner that by a certain degree of inflammation, a peculiar thin, clear secretion is formed resembling lymph, and which is changed by the vitality of the part into pus; a fluid which is modified in its nature and properties by the cause affecting and the part affected. In a short time it changes to a limpid consistence, or to a fluid of the thickness of cream; and from a pale white appearance, to a white, yellow, greenish or red colour, varieties which seem all to depend on slight changes in the principal constituents of the secretion. These changes are of the same nature as those which occur in the blood of the ovum. When first formed, the blood in the yellow membrane is of a transparent appearance; but globules are soon formed in it, and it changes from a yellowish to a brown, and then to a red colour. It is in the same manner that milk is formed; and it is very probable that the use of lymphatic glands is to modify the contents of the absorbents by producing globules, &c. so as to render them fit to be received into the circulation.

As inflammation can always be produced by a certain degree of irritation, so its consequent pus may be produced, and secreted for any time, by keeping up the necessary degree of inflammation, as by an issue, &c. As this inflammation decreases the secretion becomes of a serous quality. In like manner, after an abscess has been opened, it secretes thinner pus than was formed in it when opened, and as the inflammation diminishes, and the cavity contracts, serum is evacuated until it heals up.

When an inflamed part is highly organized, it soon diminishes

by the absorption of interstitial tissue, and the removal of the purulent deposit. When the part affected is not so highly organized, and the inflammation subsides with more difficulty, its symptoms continue after the abscess is formed, as around ligaments, bones, &c. In some cases abscesses are absorbed, and it is probable that the pus is removed in the same way as it is secreted, so that it undergoes a considerable change in its passage to the vessels, which renders it capable of being absorbed in considerable quantities without injury. Without this change in the properties of the pus its entrance into the circulating system would probably always prove fatal.

§ 4. ULCERATION. The balance between the action of arteries or secreting vessels, and absorbents, is continually changing, in order to answer the purposes of the constitution. In the young the secreting vessels are more active, so as to perfect the bodily frame; in the healthy adult the secreting and absorbing vessels are in proportion to each other; while in old age, the secreting are weaker than the absorbing vessels; so that in aged decrepitude the body is found wasted, and even the bones thinner and weaker than in the adult.

In disease, the ordinary balance between these two sets of vessels is often changed from its natural state. In inflamed parts, the secreting vessels become morbidly active, and a swelling is the consequence; if the inflammation be locally severe, and long continued, the central portion loses its elasticity, softens, and dies. Should the irritation continue, the absorbents become more active in order to separate the dead part, and an open secreting sore, called an ulcer, is formed. When long continued strong pressure has been applied to an external part of the body, it is no longer able to perform its functions, and the absorbents remove the part, forming an ulcer. In like manner, such parts as are most deficient in the active powers of life, or are at a distance from the heart, soonest take on this action; and parts of the least importance to life are, for the same reason, soonest removed, as the cellular tissue, &c., while more important parts, as blood-vessels and nerves, are left to the last. Such differences are owing to the degree of vitality inherent in different parts. Thus a strong originally formed part is in a healthy state much less liable to ulceration than a weak newly formed part, which is even disposed to ulcerate by a slight stimulus.

H

When natural circumscribed cavities are exposed they often inflame, suppurate, and granulate, without any loss of substance. Ulceration, therefore, although a general, cannot be considered as an invariable, consequence of inflammation.

When an ulcer is examined with care, it will be found that the inflammation diminishes towards the circumference of the sore, and that the adhesive inflammation reddens and swells its margin; as the ulceration proceeds, this adhesive process prevents the occurrence of hemorrhage, and the introduction of noxious secretions into the system. In other cases the pus is first modified, and then absorbed without detriment.

In a less healthy state of such sores, the surrounding adhesive inflammation is not so well marked, and a more liquid sanious discharge takes place, and hemorrhages are liable to occur.

§ 5. GRANULATION. When the surfaces of a divided part of the body have not united by adhesive inflammation, suppuration is established, and the usual loss of substance is made up by the secretion of portions of coagulable lymph, which, becoming organized, form granulations, by the union of which the wound is said to heal. When carefully examined, granulations are found to consist of small, red, florid, and irregularly rounded points elevated above the inflamed surface, and inclined towards the periphery of the body, and the centres of canals where they cover natural passages. The size and colour of granulations vary considerably, and indicate their nature; being healthy when their margins are rounded and they are of a small size, the surface of the sore equally florid and convex, and the discharge from the surface pale and thick. When the granulations are unequal and of large size, with their margins hanging over or turned out and of a pale or dark red colour, the discharge being at the same time a permanently thin secretion from their unequal surfaces, they are said to be unhealthy.

The formation of granulations seems to depend on the secretion of the arteries containing more coagulable lymph than is alone required for the formation of pus; so that some of the secreted fluid is deposited upon the surface of the part to form granulations, and another portion is changed into pus. The deposit of coagulable lymph consolidates and becomes so vascular, as to bleed upon being roughly touched in consequence of the formation of new vessels.

These granulations are the same wherever produced, but after becoming organized, they change by their inherent vitality into a tissue resembling that of which they supply the place.

Granulations have naturally a strong inclination to unite so as to fill up cavities, and to contract so as to diminish cicatrices. When the part is less vital, or is kept pendent, so that the circulation is impeded, the granulations become of a dark colour, and have less inclination to unite; this is entirely in consequence of the slowness of the circulation in the new and weak part.

Deep abscesses rarely show much disposition to granulate as long as their openings are small, when a sanious and not a purulent discharge takes place; even when pus has been formed at first, unless the abscess is opened freely, the secretion is liable to become unhealthy.

So much do granulations appear to depend upon exposure of parts to the air, and to the way in which new surfaces are defended from external objects, that when internal parts in a healthy individual have been slightly torn, and the divided surfaces kept separate, pus is not secreted. In these cases coagulable lymph fills up the deficiencies, consolidates, becomes organized, and undergoes changes which fit the parts for their particular functions. This method of reparation is seen in the union of the fractured patella, olecranon, and ligaments.

The last manner in which healthy or accidental inflammation terminates, is by the death or mortification of the part. This generally occurs when the inflammation is so severe, and the consolidation of the blood in the vessels so general in the part, as to destroy its vitality, increase the violence of the inflammation, and render it of a general or erysipelatous nature, such as occurs along with severe burns, extensive wounds, frost bite, &c. But such is the powerful influence of nature in preventing this effect, that it rarely occurs, unless when the part has been greatly debilitated by the powerful influence of the cause, or by the deranged state of the constitution.

Gangrene is divided into humid or acute, dry or chronic, white or black, &c. Although custom and authority may seem to justify such artificial or arbitrary divisions, yet the varieties are often produced by like causes, found existing together in the same individual, and afford no assistance in forming the prognosis or plan of treatment. A more natural and useful arrangement is founded on the

causes which have produced the disease; or into accidental, symp-
tomatic, and specific. The first, including such cases as are produced
by the severity of local diseases, as injuries; the second, such as are
symptomatic of the state of the constitution; and the third, such as
follow from the specific action of certain substances, such as the ergot
of rye, &c. It is the first variety which will be here considered.

§ 6. GANGRENE. The occurrence of gangrene after injuries de-
pends upon the extent of injury which the soft parts and joints, the
blood-vessels and nerves have sustained, and on the state of the indi-
vidual's constitution. Some of the most difficult cases of surgery
in reference to deciding upon the moment in which the knife is to be
used, on leaving the case to the resources of nature, the place at
which amputation is to be performed, &c. are connected with the
occurrence of gangrene.

The causes of this species either act directly or indirectly. The
first, or direct, causes of accidental gangrene, are the cessation of
the circulation in a part, the nervous energy being destroyed, or the
action of sedatives applied to weakened parts. An example of the
latter form of gangrene is related by Sir A. Cooper, which was
produced by an ignorant pupil applying Goulard's wash during a
whole night to a limb in a state of weakness, from the femoral artery
having been tied for an aneurism.*

In violent bruises or extensive wounds, including those of the
principal nerves or large blood-vessels, tight bandages round parts, or
pressure upon weak parts, severe cold, burns, escharotics, poisons, or
the like, parts may be so weakened, and so much disorganized as to
be no longer capable of carrying on their natural functions, and so
sphacelate. The following cases are examples of this variety.

CASE 1.—A boy, 13 years of age, in indeavouring to reach a kite, that
had become entangled in a high tree, fell to the ground, broke the left
thigh-bone, and dislocated the two wrist-joints, the bones of which were
partly thrust through the skin. He was brought to me from a consider-
able distance, and I found small wounds at the ulnar side of the left, and
radial side of the right wrist, with the glenoid cavity and styloid pro-
cess of the radius broken and crushed. There was little hemorrhage.
Having replaced the bones, and secured the fractured parts in splints, I
ordered some medicine to be given to him, and he was taken home.

* Med. Chirurg. Transactions, vol. 3. p. 254.

I heard no more of the boy for two days; when on sending to enquire about him, I found that gangrene had appeared in the right hand, and that the other hand and thigh were swelled, and painful. In vain I requested his friends to bring the boy to the hospital, as the only chance of saving him, by removing the arm. A native surgeon dissuaded the parents from this step, saying, the case was quite hopeless. The poor boy lingered for seven days.

On dissection, a line of demarcation between the dead and living parts had taken place, and this appeared much firmer and more swollen than elsewhere. The cellular tissue had a hard swollen appearance, and below was greenish and unhealthy, strongly foetid purulent matter extending upwards to different distances among the vessels and between the muscles. The artery had its natural appearance, but was contracted in size near the elbow-joint, where it had unfortunately been divided. The veins were dissected with difficulty, on account of the dense cellular tissue in which they were imbedded. As they approached the elbow-joint they were found suddenly contracted in their size, and much thicker and denser in their tunics, and upon them numerous vasa vasorum were ramified, giving their external coat a red appearance. At one point a portion of consolidated blood was found; but nature, in this case, appeared to have removed, during the period of weakness which preceded death, the greater part of the changed blood before the disease had extended so far as to destroy the patient.

In this case amputation would most probably have saved the patient's life, as the complicated fractures were found in a favourable state; and dissection proved how well nature had acted in endeavouring to prevent fatal consequences. It also afforded an example of the progress of sphacelus in the different tissues : first, affecting and extending in the cellular tissue and muscles, then the veins, arteries, and nerves, in succession.

CASE 2.—A boy, 10 years of age, fell from a tree upon his left elbow, and broke the condyles of the humerus, the extremity of which had forced itself through the skin, at its anterior part. Nothing was done for the unfortunate boy, but a small shell or cowrie had been appended to his wrist, and some prayers repeated. Three days afterwards he was brought for advice, with the extremity of the bone still protruding, the fore-arm and hand much swollen, cold and œdematous ; the cuticle was raised into

light red coloured phlyctænæ round the wound, which had a gangrenous appearance and smell.

In this state the arm was removed above the elbow, where there was a hard swelling from the deposit of lymph; evidently the first or adhesive stage of inflammation, by which nature separates the gangrenous part. On examining the arm the cellular tissue generally was found enfiltered with yellowish serum, and among the muscles much extravasated blood was seen, partly in a thin purulent form, and of a gangrenous fœtor. The condyles of the humerus were crushed, the superficial veins of the fore-arm natural. The humeral artery was next examined, and as it passed through the centre of the gangrenous part, its tissue was found of a dark brown colour, and so soft as to be easily torn; two inches above and below, two portions of consolidated blood were situated. The smallness and diseased state of the parts prevented my examining, with sufficient exactness, the state of the deep-seated veins. The patient rapidly recovered.

CASE 3.—A middle-aged woman was employed by a person to catch fish during the night, and while stooping to remove a thorn which had penetrated her foot, she was suspected to be secreting a fish, and a person behind gave her a severe blow with a large stick, which fractured the olecranon, and injured the elbow-joint. Being discarded by her friends and relations when most requiring their assistance, a case by no means uncommon in a rude state of society, she was sent by the police from a great distance to the station. When I first saw her she was insensible, and breathing with great difficulty; the pulse was imperceptible at the wrist, and death occurred an hour after.

The hand and fore-arm were much diminished in size, the muscles reduced and contracted in length, so that the fingers were bent upon the palm of the hand, the vessels shrunk and empty, and the cellular tissue relaxed and free from fat, so that the skin moved freely upon it. This had undergone a great and peculiar change; being soft, pliable, and of a deep black colour, as if a black glove had been drawn over the bones. This peculiar change was evidently the last that nature had produced in the part; which was proved by its reduced state, as well as from the specific smell and change of colour, which was not the effect of simple putrefaction. Immediately above the elbow-joint the line of separation had commenced, and already the skin was separated all round from the black envelope below, presenting an unhealthy yellowish granulating surace, which had a most disagreeable characteristic smell.

On separating the muscles of the arm, several collections of yellowish

and very fœtid pus were discharged from the inter-muscular cellular tissue, between the elbow and axilla; on examining the elbow-joint, it was found entirely disorganized, full of pus, with the olecranon and part of the condyles of the humerus broken. The subcutaneous cellular tissue was thickened immediately above the ulceration, and particularly along the course of the principal vessels. These were found filled with consolidated blood at different distances, according to their position and degree of vitality. The humeral artery was closed immediately above the elbow-joint, the veins being, at different distances, filled with firmly adhering detached portions of consolidated blood. These vessels were imbedded in dense cellular tissue, and had very numerous enlarged collateral branches.

This case has a considerable resemblance to the former, and had it been seen at a somewhat earlier period, would have afforded a favourable opportunity for amputation, a course which saved the life of the boy in the former case. The injury seemed not to have destroyed so many of the vessels and nerves of the elbow-joint, as to have immediately produced what might have been expected, moist gangrene; but, gangrene having occurred, its progress was slow, as the principal vessels of the arm escaped, and allowed the gradual development of the natural changes in the fore-arm, which form the characteristic appearance of what is called dry gangrene. Such distinctions, founded on the result of the disease, are improper, and being useless in practice, should be discarded from nosology.

The second or indirect class of causes producing accidental gangrene act as stimulants to parts in a state of great weakness; as applying heat to a part weakened by cold, or wounding or otherwise exciting an action greater than the power of the part can continue to perform. The tendency to gangrene is thus increased by augmenting the local debility at the already weak part; or, as Mr. Hunter expresses it, " by destroying the balance which ought to subsist between the power and action of every part."

The symptoms of this species of gangrene are, a burning in the part, which becomes purple, bluish, or livid; from the obstruction to the return of the venous blood, and the part changes to a white ash-colour, as the circulation becomes more impeded, as in frost-bitten parts. In this form of gangrene the part feels heavy, cold and insensible, and discharges from the surface a sanious, fœtid, thin

secretion which has the peculiar characteristic smell of gangrene, with flaccidity and emphysema in the part, and phlyctænæ, with a livid circle round their base.   The ash-coloured part becomes partially black, while the livid redness diminishes in intensity; it exhibits black, and in other parts, ash-coloured spots, interspersed with vesicles.   In more chronic forms, which admit of the natural changes being developed, we have seen that the colour becomes dark and the part more shrunk.   Both these changes indicate a vital act in the vessels, which removing the fluids, prevent the putrefactive fermentation; after which the fat muscles, &c. are absorbed.   The dark colour is also a vital change, and explains the instance related by Mr. Burns, "in which a limb became cold, insensible, and quite black, but not dry, and afterwards recovered its powers, and became of a yellow tinge."*   The blackness and dryness increase, as the vitality is weakened, and the part dies or sphacelates.   These changes in colour depend likewise on the physical properties of the part, as well as their vitality.   A bone or tendon remains unchanged, while the highly organized skin becomes first livid, then pale, dark, and lastly quite black.   These changes are the natural course of mortification, and do not occur when the injury is proportionally much greater than the powers of the part; this is then suddenly destroyed, involving the neighbouring parts, which pass at once to the putrefactive fermentation, from being moist, as the vessels have not strength to absorb the interstitial fluids.

After a severe injury to a part, it becomes cold, pale and discoloured, and gangrene is threatened ; but the limb may be saved by judicious treatment.   When reaction takes place nature attempts to heal up the injured part; if this is too extensive, to remove the dead part.

When a part is affected with gangrene, the system participates; severe symptomatic fever occurs, with small and hard pulse, which often continues till within a few hours of death.   It then becomes fluttering, weak, and hardly to be counted.   This is accompanied with a great and characteristic change in the expression of the countenance. The eyes are heavy and dull, the cheeks flattened, the nostrils contracted, and mouth widened.   The countenance is not expressive of

* On Inflammation, Amer. ed. vol. 1. p. 201.   See also O'Halloran on Gangrene, pp. 35 and 139.

much pain, but of the utmost anxiety, with a peculiar wildness of aspect. There is often vomiting, a peculiar restlessness, great depression of strength, the extremities are cold, and cold sweats break out, with distressing hiccough, nausea, and vomiting; sometimes diarrhœa, and more or less delirium, occur before the patient sinks.

In cases in which a part is in a state of sphacelus, and the constitution is strong, the powers of the system may be sufficient to arrest the progress of the disease and its effects. The process by which nature separates large members without hemorrhage, or endangering life, forms a most curious example of design in the accomplishment of a particular end.

The irritation which the gangrene produces becomes so severe in the part which separates the dead from the living portion, that inflammation of an adhesive nature is the consequence, and this fills up the large blood-vessels with consolidated blood, or blood in the state which indicates the adhesive stage of inflammation. This extends to considerable distances from the sphacelated part, and explains the reason why, on amputating a sphacelated limb, no bleeding occurs. In describing such an operation the accurate O'Halloran remarks, " The extremities of the arteries seemed closed by a black plug; and, though bathed with a sponge and hot water for some time, not a drop of their contents escaped."[*] This has been supposed to be a mere coagulation of the blood in the vessels; an opinion unphysiological, as we cannot properly suppose that the " coagulum of blood," which has lost its vital properties, " extends to the living vessels which join it, and is, in this manner, glued to the inner side of the artery;" that a dead part unites to a living " to hermetically seal it, so as not to allow a drop of blood to escape by the side of the coagulum." From the careful and reiterated examination of diseased vessels, I have invariably found that when a certain degree of irritation has been applied to a living vessel, it acted locally on the blood by increasing its vitality; in which state it is no longer capable of remaining in its fluid condition, and becomes solid or consolidated.[†] Should the vitality be diminished, the blood again becomes fluid. The extent to which such consoli-

[*] On Gangrene and Sphacelus, p. 41.
[†] See Calcutta Journal of Medical Science, vol. 1.

dated portions of blood advance in living vessels, is very various ;
depending, not only on the constitution and cause, but also on the
stage of the disease in which the parts are examined. In some
cases the vessels, but particularly the veins, are very extensively
filled with the changed blood, but, when the system is stronger, and
the cause less acute, the consolidated blood is in smaller quantity,
and the adhesive inflammation in the soft parts is more extensive.
This is in accordance with the law observed in the progress of gan-
grene in soft parts ; the rapidity of the formation being proportion-
ally quicker in the more vital tissues, and the extent being greater
in the veins than in the arteries ; in the cellular tissue than in the
muscles; in the weak than in the strong parts; and this from the diffi-
culty which nature experiences in arresting the progress, in an un-
healthy state of the system. As nature advances in the cure, the con-
solidated blood is again removed, the large vessels contract as the
smaller ones enlarge in size, and increase in the importance of their
action, so as to thicken the cellular tissue, and thus separate the dead
from the living parts.

Ulceration next occurs, which is known externally by the appear-
ance of a white line at the separation of the dead from the living
part, and indicates the cessation of the gangrenous disposition of the
part. The cuticle is raised by vesication, being separated from
the cutis vera, in consequence of the weakened absorption, and
consequent accumulation of secretion in the part. Soon after,
a small line or series of minute holes forms in the living parts
in contact with the dead. These slowly unite, and separate the
living from the dead part. This is done by slow degrees, in propor-
tion to the vitality of the tissue. When the vitality is great, it re-
sists proportionally longer the approach of this state ; and when gan-
grene occurs, it runs its course more rapidly to the state of sphacelus.

The rapidity with which gangrene advances, depends on the vitality
of the part affected, on its situation near the trunk, and the vitality
of the individual tissue. The skin, muscles, and nerves being highly
organized, the separation between the living and dead parts takes
place quickly ; the cellular tissue and tendons of muscles being
less so, the gangrene advances further into the living parts, and
the separation is slower, so that in sloughing sores the cellular tissue
suffers severely, and tendons usually separate where they unite with

the muscles. The knowledge of this fact explains the principle upon which surgeons now act in cases of traumatic gangrene, where they amputate before the line of separation has taken place, and also accounts for cures being accomplished even when the cellular tissue is in a state of gangrene, above the part amputated, as this dies at an early stage, and when the muscles are still in a healthy state. In such cases, the more vital tissues remove the diseased parts by ulceration and suppuration.

The indications of cure in accidental gangrene may be reduced to the following heads:

1. Removal to the greatest extent possible of all exciting causes, such as ligatures, acrimonious substances, pressure, &c.

2. Diminution of distressing symptoms, by reducing the too great vascular action, and by a moderate and judicious use of antiphlogistic remedies. Such evacuations must always be employed with much circumspection, and are not generally required. The pain and irritability are to be diminished by the occasional exhibition of opium, particularly in the form of Dover's powder, which also tends to equalize the temperature of the skin.

3. Promotion of equable circulation in the part, by heat and moisture. The only exception to this course is, when they are opposed to the feelings of the patient, or when mortification is produced by cold. In poultices, antisceptics and gentle stimulants may be used with advantage, such as charcoal, the chloride of lime, camphor, &c; or the yeast poultice may be applied.

4. The vigour of the system is to be supported, and constitutional symptoms combated, so as to admit of the dead part being removed, by gentle mercurial aperients, and by the exhibition of tonics, acids, mild nourishing diet, &c. which ought to be given during the remission of the fever; while nature is separating the sphacelus, a more nourishing diet of animal food is required, with a certain quantity of good wine.

5. A question of much importance is the period when the part should be amputated in cases in which nature is found incapable of completing the separation. The principles cannot be correctly laid down, as each case has its own peculiarities, which alone must regulate the surgeon's proceedings. In traumatic gangrene the salutary consequence of removing a member, involved in gangrene, has been

clearly proved by Baron Larrey and the English Army Surgeons; amputation separates the mass of diseased parts, and permits nature to rally, so as to heal up the wound made during the operation, which is always in parts possessed of a high degree of vitality.

In gangrene from cold there is much less fear of the disease re-appearing in the wound; and the cause being removed, the salutary operations of nature are more readily assumed in completing the cure of the wound.

Mortification sometimes produces such fever and consequent debility, that before any attempt is made by nature to stop the disease, the patient is destroyed.

The explanation of this vital process is very evident, from the well established fact, that ulceration is always preceded by adhesive inflammation, although its degree will be modified by the powers of the system. When the system is weak, or the inflammation is very severe, the purulent secretion is greater than the system can defend itself from, by the adhesive inflammation, on which account the morbid fluid is admitted into the system, and the patient dies. The same is sometimes the case when a member mortifies from any cause; but when the person has a strong constitution, the adhesive inflammation is sufficiently powerful to form the proper boundary; and large portions of the body are often thus removed. In such cases no hemorrhage occurs; and even when the assistance of the surgeon is required, and a limb so affected is removed above the inflammatory redness, few or none of the vessels bleed. The consolidation of blood will often extend a considerable distance from the part ulcerated, and vary according to the size of the vessels, the number of their branches, the state of the blood, and the constitution of the individual. I have seen examples of very extensive consolidation of blood having taken place in different parts of the body, forming the first stage of sphacelus, or the process of removing a part when mortified.

CHAPTER V.

INTERNAL INFLAMMATION.

In the preceding remarks we have only considered inflammation as it occurs externally, when its symptoms are evident to the senses. We have next to consider the peculiarities of such inflammation as it occurs internally. The nature of the disease being the same in both cases, we shall confine our remarks to the consideration of the symptoms by which internal inflammation is known. These symptoms are pain in the part, which is generally the only symptom of external inflammation present; the other symptoms of inflammation—colour, heat, and swelling, being masked by the position of the disease. It is the situation, nature, and severity of the pain which generally lead the individual to suspect the presence of the disease, and the physician to the means of curing it.

The second class of symptoms by which internal inflammation, occurring locally, is known, are its effects upon the functions of the organs affected, which are in general perceptibly, though somewhat variously, altered. To the pain is added the distress accompanying the increased sensibility, and unnatural state and condition of the organ affected, and parts around it. In other cases the internal inflammation may act on other more remote parts; the shoulder, for example, becomes painful in diseases of the liver, &c.

The swelling which accompanies inflammation in particular parts may also impede the functions of neighbouring parts; there is for instance difficulty of deglutition, along with inflamed tonsils, &c. But the chief consequence of internal inflammation arises from the importance of the organs affected, which render the effect more powerful, and produce that feverish state of the body, which is indicated by the more tonic state of the blood, by the rapidity of its circulation, by the increased heat of the skin, by the diminution or change of the usual secretions, together with the more or less general or local feeling of uneasiness or pain.

CHAPTER VI.

APPEARANCE OF INFLAMED PARTS ON DISSECTION.

Before considering the appearances left by inflammation after death, a few remarks may be made on those produced by congestion.

This is caused by a certain degree of irritation, or local debility, which so affects the capillary vessels, as to cause an increased flow of blood to the part, without its being of that degree of tonicity as to produce a consolidation of the fluid in the vessels. This congestion may take place naturally, as to the genital organs, &c.; and in all diseases, there is sooner or later such a determination to parts; but the most frequent forms of such diseases take place in the tegumentary organs, and in the parenchyma of viscera; as the lungs, liver, spleen, and brain.

The appearance of congestion, or the irregular distribution of blood, before as well as after death, is produced by various and different causes. The appearance of this state after death cannot be relied on without the symptoms, or other individual circumstances, before death, confirming these appearances. The following are some of the causes producing the appearance of congestion after death:—

The contraction of the heart which precedes death forces the blood along the arteries, and the tonic action which continues in the capillary vessels, for a considerable time after death, forces the blood still further forward. The experiments of Hunter and Parry prove that after death the arteries contract more forcibly than can be accounted for by their mere physical properties, and are left empty by their forcing the blood forward to the less resisting capillary veins, which are found after death filled with blood. This explains the numerous distended veins so often seen under the tegumentary coverings of strong individuals after death. This engorgement is rendered still more evident when death takes place from any cause impeding the return of the blood to the heart, as in strangulation. The blood next slowly coagulates, and as the serum quickly exudes through the coats of the vessels, a much smaller

quantity of blood is found on dissection than we are led to expect from the quantity known to exist in the system during health.

The appearances of congestion on dissection, therefore, depend much on the state of the blood and tissue of the vessels at the time of death, the immediate cause of death, the temperature of the atmosphere, the period at which the examination is made, and the situation and position of the part of the body which is congested. These effects produce appearances of congestion of blood immediately before or after death in the skin, most vascular parts, mucous membranes, and parenchyma of some of the viscera.

Another cause producing the appearance of congestion after death arises from the nature and suddenness of the death. In some cases the blood remains fluid, and gravitates downwards to such parts as offer the least resistance to its accumulation. In other cases, as of typhus or putrid fever, the blood remains fluid, and the tissue of the vessels quickly passes to the softer state of putridity, when imbibition of red particles takes place; and a red blush is produced which is not at all connected with inflammation during life.

When such congestions take place immediately before death the appearance of redness may disappear after it; and even in cases of congestion the above causes may remove the usual appearances found in such circumstances after death.

In slight cases of inflammation very little of the characteristic redness may be present, in consequence of the slight degree of consolidation of blood in the vessels, and the congestion around the part being removed by the contraction of the vessels as death takes place. This can only take place in very slight cases of inflammation.

The changes left after inflammation will vary with the stage of the disease at which the person died, and with the tissue affected.

1. The above remarks afford us the means of deciding on the presence or absence of inflammation in a part. When the appearances of congestion are absent with the presence of consolidated blood in the vessels of the part, inflammation must have been present during life. This fact enables us to explain the appearances found on dissection in the various stages of inflammation, and to explain the changes discovered on dissection in different stages of its course. In the first stage the part is red, and by the permanent character of the consolidated blood which remains after death, it is not changed, or

but slightly changed, on exposure to the air; nor does staining in the neighbouring parts occur, nor can the colour be removed by pressure or washing, until putrefaction has commenced.

In the second stage the part is found thicker and denser; and,

In the third stage, the tissue becomes softer, with the appearance of coagulable lymph on its surface. When proper care has been taken to avoid confounding lymph with thick adhesive mucus, it forms the most unequivocal proof of inflammation having been present during life. These softened parts break down, and sacs form which contain pus.

2. The appearance of inflamed parts varies with the tissue affected. When a secreting surface is inflamed, the redness of the part is soon followed by an increased secretion, which contains more of the coagulable lymph than usual; indicating the increase of morbid vitality in the part, by which the quantity of this, the pabulum of new parts, is secreted.

When the parenchyma of an organ is inflamed, after the local redness and hardness of the inflamed part have subsided, it becomes lax, soft, and pus is secreted into it. These changes are peculiarly evident after inflammation of the liver and brain.

CHAPTER VII.

TREATMENT OF INFLAMMATION.

The object of all theories of disease is to arrive at certain principles for their prevention or cure; which form a criterion of the soundness of the opinions formed, and lead to conclusions from which new inductions may be drawn.

The above remarks on the nature of inflammation will lead us to conclude that they admit of the application of certain fixed principles for their cure, which, however, require modifications, not only on account of the tissue affected, the stage and degree of severity of the inflammation, the age and temperament of the individual, and the type of the fever produced, but also from the modifications of the inflammation itself.

It is when inflammation endangers the life of a part, or the life of the individual, that remedies to prevent its farther progress are re-

quired; in other cases the action of inflammation has to be induced
and promoted, for obtaining effects necessary to the restoration and
integrity of the part.

The treatment of local inflammation should always be commenced
by making an examination of the part which is its seat, and re-
ducing those causes which may either cause or keep up the irritation.
For this purpose, foreign substances are to be removed, and the irri-
tating secretions, which inflammation frequently produces, should
be rendered milder; or the parts should be defended from their ac-
tion by medicines or bandages.

The next intention is to diminish the tone of the system by absti-
nence and depletion; and that of the part by evacuants and seda-
tives, as cold, saturnine washes, opium, &c.

By the local abstraction of blood, the volume of the fluid is les-
sened in the part, and, the sthenic state being abated, whilst the for-
mation of more consolidated blood is prevented, the removal of what
has already been formed is promoted. This fact should never be lost
sight of in treating irritation. Should a severe inflammation occur
in an extremity, the force of the circulation there is greater than it
is in the opposite extremity. A proof of this fact may be obtained
by bleeding, in such a case, from both extremities at the same time;
the blood of the extremity which is inflamed will then flow faster,
coagulate quicker, and present a tougher crassamentum than that
obtained from the extremity of the healthy side. This is the result
of trials which I made to determine the point; and proves the
advantage of making the abstraction of blood from the neighbour-
hood of the affected part. The employment of leeches, cupping, or
scarifications will be employed with greater advantage according to
particular local circumstances. Scarifications may sometimes be
employed more advantageously than other evacuants, in severe
inflammations of a considerable portion of a member; they act by
relaxing the parts, emptying inflamed or rather congested vessels,
and at the same time evacuating any imperfectly formed suppuration,
and thus bounding the extent of the inflammation.

These local evacuants should, therefore, be employed as near the
part inflamed as can conveniently be done. In diseases of the brain,
as there is a large vein which passes directly from the lateral sinus
through the maxillary process of the temporal bone to the jugular

I

vein, by opening this vein, blood may be removed immediately from the seat of the disease. For a like reason, hemorrhage from the nose is of great use in diseases of the head. The effect of such a natural effort of nature to relieve herself may be produced, or increased, by cupping, leeches, &c. in all cases in which the local inflammation has not affected the system, or when such a general affection has been removed by venesection.

In diseases of the chest, particularly of the heart, and also of the abdominal viscera, great advantage is obtained from the repeated application of leeches over the part affected. We do not know how such evacuants act, as experience has proved that their effect is much greater than the quantity of blood alone would lead us to expect. In inflammation of the mucous membrane of the intestines, much relief is obtained from the application of leeches around the anus, probably by diminishing the quantity of blood in the hemorrhoidal veins. Such an effect is particularly evident in inflammation and other diseases of the rectum.

The next indication is to apply heat and moisture, conjoined with oleaginous substances, to relax and relieve the vessels of their distention; with these means antispasmodic, anodyne, and sedative applications will be found of great use, particularly in cases of nervous inflammations. Opium diminishes both local and general irritability, and may be employed with great advantage especially in irritable habits, and where there is much pain. When the nervous temperament is not particularly marked, the use of evaporating lotions, as of alcohol, ether, &c. and other forms of cold, with preparations of lead, will be found of great use when applied so as to produce their weakening effects. Such applications have a local sedative effect that is more permanent than that of opium, producing a change of constitution in the extremities of nerves, and diminishing vital action. In this manner they diminish the increased action, and the pain in inflammation. Opium and sedatives produce the same effect when taken into the system in sufficient quantities. The oil of turpentine, the nitrate of silver, &c. have a salutary effect probably by acting as constringers of the vessels of the inflamed part, and thus relieving the distressing symptoms of inflammation. The use of turpentine in burns is well known.

When pressure is properly graduated, from the termination of

an extremity, it will often be of great use by diminishing the velocity of the circulation, more particularly in the arteries, whilst it supports the distended veins.

There is such a sympathy between local inflammation and the functions of parts, that any considerable affection of an organ is always accompanied with a certain degree of constitutional disturbance. In like manner, with the local means of reducing the sthenic disease, much advantage will be derived from means being previously employed for reducing the general force of the system. Whenever the inflammation is severe, or the organ affected is important, general bleeding becomes necessary, followed by local means for reducing the inflammation. Venesection is the most powerful antiphlogistic remedy we possess for checking the most important class of diseases; but the quantity of blood to be abstracted will vary under different circumstances, such as age, sex, habit of body, climate, organ affected, &c. When improperly performed, the loss of blood may produce most dangerous, and even fatal, consequences. The profession is much indebted to Dr. M. Hall for his valuable remarks on this subject.

When general blood-letting has been performed at a proper stage of the inflammation, and in a sufficient quantity, it produces the following effects.

1. It diminishes the fever, the pain, especially of the head, intolerance of light, and the burning heat of the skin, &c.

2. It removes coma, faintness, depression, and the sense of weakness; it diminishes the frequency of the pulse when too rapid, and increases its frequency when preternaturally slow, and it gradually improves the state of the tongue.

3. It checks the nausea and vomiting, which sometimes accompany severe inflammatory fevers; it removes coldness, dryness, and local perspirations; and increases the effects of diluting and diaphoretic medicines by equalizing the temperature and moisture of the body.

4. It renders the action of medicines more certain, and induces sleep.

5. It checks diarrhœa, prevents the effusion of serum and blood. the malignant termination of fevers, gangrene, relapses and the sequel of diseases, such as consumption, jaundice, dropsy, &c.

The importance of these matters induces me to add a few remarks

I 2

on the subject of bleeding. When venesection is employed in health, the pulse is soon diminished in size and frequency by the evacuation, and syncope is produced. In such cases, if the evacuation has been large, a reaction takes place; the heart contracts more frequently, so as to hasten the circulation of a smaller quantity of blood, to make up for its loss of bulk, and pain is felt in the head. These symptoms I have seen mistaken for inflammation of the brain, for which the lancet was again had recourse to, not only without benefit, but with the worst effect on the constitution of the patient. The headache in these cases seems to be the effect of the debility induced acting on the brain, from the case of bone in which it is contained requiring that a certain quantity of blood should be there, and as that is diminished in the weakened arteries, the blood increases in the veins, —an engorgement of venous blood, in short, takes place and produces headache. The following is an example:

A strong muscular man was brought to the hospital on account of an injury of the chest, which he had received by a fall. On examination it was found that two or three ribs were fractured near their angles. Emphysema with its accompanying symptoms appeared, and was combated by several bleedings. The patient continued for several days improving, when it was thought necessary again to bleed him, after which he complained of headache; and his pulse was small and frequent. He was bled by another surgeon with a recurrence of the same symptoms, for which the lancet was again had recourse to for the seventh time in four days. After this he gradually sunk. On dissection, the lung at one part appeared in a state of hepatization, and the veins of the membranes of the brain contained much blood. The brain was colourless; the other veins, with the arteries, were unusually empty.

The effects of blood-letting are different according as the blood taken is arterial or venous. The abstraction of blood from the arteries is not in general so efficacious as that from the veins, venous blood being obtained from a class of vessels which is not so much under the power of the circulation. By removing a quantity of blood from these vessels, we diminish the mass without producing any reaction. Thus blood-letting if it be indicated may be practised in a disease of the eye, from an artery near the disease; but reaction takes place, and less good is done permanently, from an ordinary quantity, although temporary relief may be obtained; for in every inflammation

local bleeding from the part is more efficacious than at a distance from it. On the other hand, in the veins, particularly of the extremities, when they are in a varicose state, the blood is contained in a kind of reservoir. Here it can be removed in very considerable quantities, without any marked effect being produced upon the system. In very severe cases of phlegmonous erysipelas, in which the patient is so weak in consequence of extensive disease, as at first to seem to preclude all hope of medicine being of any use in checking the disease, I have seen large incisions made in the inflamed part, accompanied with a very considerable discharge of blood, produce little depressing effect upon the system, whilst it removed the dangerous symptoms. The following is an example :

CASE.—A woman, in the 7th month of pregnancy, was attacked with phlegmonous erysipelas, which extended from the foot to the thigh. The whole leg was very much swollen, the part cold, and her pulse so small and fluttering, that wine was obliged to be given to recruit her. An incision was made from the heel to the ham; 14 oz. of blood were lost with instant relief. No bad symptoms followed, although such an evacuation from the wound might have been expected to have produced much general depression and perhaps abortion.

Bleeding may always be employed without fear when there is an active inflammation of a considerable internal organ, when the veins are distended, and the arteries full and frequent in their action.

When inflammation is accompanied with a great distention of vessels, but there is much resistance to the distention of the part, warmth and moisture are of great use in relaxing it, and diminishing increased action. Poultices are used both for soothing and relaxing parts; but when very irritable, opium will be useful in removing this state as well as the inflammation. The necessity of employing general bleeding may be known by the state of the pulse, which will be hard, frequent, and with difficulty compressed; by the skin, which will be hot and dry; by the appearance of the tongue, which will be white and dry; and by the pain in the organ affected, and the nature of the disease. It is a combination of these symptoms, and not any one separately observed, that must guide us in our line of conduct.

The pulse must always be considered in connexion with the disease, and with the effects which venesection produces upon it. In

enteritis, the pulse is small and feeble; while in certain states of exhaustion, from the loss of blood, the pulse is full, quick, and bounding. In the former case, the blood flows at first slowly, and is of a florid colour. When the colour becomes less vivid, the pulse gets fuller and stronger : then the propriety of the evacuation is proved. The pulse becoming feeble indicates its impropriety. The yielding of the painful and dangerous symptoms, and the production of syncope, show our having obtained its full effect.

The great endeavour in dangerous diseases must be, to make this impression on the circulation, and consequently on the disease; when this is done, we shall have more time to employ means for reducing permanently the force of the circulation. The bleeding is to be accomplished so as to take a considerable quantity of blood in a short time.

We must not, however, suppose that the loss of blood is to be accounted as nothing in itself; it is a drain upon the system which, if the individual be strong, can be supplied, and the evacuation will soon be recovered from. When the bleeding has been copious, the debility produced is very considerable. It weakens the body, and renders it liable to other diseases. On this account we must be as sparing of it as circumstances will allow ; always recollecting, that nothing is more debilitating to the constitution, or dangerous to the individual, than an inflammatory disease. The kind of disease has a considerable bearing upon the quantity of blood to be withdrawn. The effect may be accelerated or increased by bleeding in the erect or sitting position, so as to produce syncope more readily. In apoplexy, inflammation of the brain or its membranes, &c. the quantity to be withdrawn must be great in proportion to the importance of the organ affected, to the individual habit, &c. In other cases the inflammation is so extensive, that blood requires to be let even more freely ; recollecting always, that " by bleeding to incipient syncope we abstract precisely the quantity required, and that the patient will bear." (Hall).

Our first effort, therefore, ought to be to remove the disease, and our second to do so by the loss of as little blood as possible; for this evacuation is had recourse to in order to diminish the quantity of the circulating fluid. In some cases, particularly of extensive inflammation (as peritonitis), the disease may have proceeded to

such a degree as to produce great depression in the system, so that the pulse cannot be felt at the wrist; and although the most acute inflammation be present, the symptoms are masked. We must not, even in this case, employ such a bleeding in such circumstances as 60 ounces at one time. Incipient syncope will always be produced by a less quantity, and the evacuation may be repeated according to the effects of the first upon the symptoms, to the danger of the disease, the state of the pulse and heart, the strength and age of the patient, &c.

In inflammation of a considerable organ the extreme vessels are obstructed, but as soon as the bleeding has diminished the obstruction a perspiration follows; and when the disease is passing to the suppurative stage, the evacuation diminishes its severity. Fever may generally be considered as a general disease of the same nature, and is to be removed by the same means.

In severe injuries bleeding should not be employed until the patient has recovered from the impression of the shock he has sustained. When the injury has been less severe, and the patient is plethoric, bleeding may be employed to diminish the severity of the consequent inflammation.

Bleeding may be employed in strangulated hernia, dislocations, &c. to produce a relaxation in the parts. In such cases, however, the blood must be removed quickly, and the effect of its abstraction assisted by other means, as the hot bath, &c.

The force of the circulation is diminished by repeated small bleedings in cases of aneurisms, with the best temporary effects.

Blood-letting is consequently the most powerful means of diminishing the increased action and tension of inflamed vessels, augmenting secretion, and lessening and dissipating the thick and viscid blood, so that it increases thirst, and the absorption of the liquids administered.

The manner in which the evacuation of blood is to be made, will vary with the organ affected, the extent and severity of the disease, the age and constitution of the patient, the climate, &c. When local inflammation produces a considerable degree of fever, or when an important organ is affected, every means must be employed to remove the cause, and to prevent its bad effects, even at the expense of constitutional debility. To avoid this, however, as much as

possible, and at the same time to produce the required impression on the system, faintness should be encouraged. In such a state the whole powers of the system are prostrate, relaxed, and weakened ; when the patient is too weak to admit of the loss of more blood, such a degree of faintness may often be produced by making him sit up or stand. The syncope so produced is in consequence of the inconsiderable quantity of blood retained in the superior vena cava and auricle, while that in the inferior cava mounting slowly, the auricle is not sufficiently distended, and so ceases to act, followed by debility of the pulse, syncope, and the suspension of the nervous influence. When the patient is placed in a horizontal position, the blood passes more freely by the ascending vena cava to the heart, and syncope is avoided or removed.

Venesection is therefore to be performed in general in such a way as to make an impression on the system by the least possible loss of blood, which is best done by placing the patient in a sitting or standing posture, by making a free opening into the vein, and by allowing the blood to 'flow till syncope is produced. Syncope, however, will sometimes ensue in severe inflammations before the object of abstracting a considerable quantity of the circulating fluid is attained, particularly when the inflammation is complicated with a threatening of apoplexy, a disease of the heart, or any congestion. The mass of blood once diminished, syncope is the next object to be aimed at, as it produces a most beneficial effect upon disease, by promoting the equilibrium of the circulation, and thus diminishing the quantity of blood in the inflamed part.

When this impression has been obtained, our next endeavour ought to be to prevent the necessity of another bleeding ; and this is to be secured by the exhibition of tartrate of antimony and preparations of mercury. The first of these medicines prevents the necessity of abstracting so much blood as in severe inflammation would otherwise be required; which is of special importance in this country (India), where severe pulmonary diseases are so common, and otherwise require the evacuation of large quantities of blood, which, when successful in checking the progress of the disease, debilitates so much the constitution of the individual as to make a change of climate necessary before he is restored to health and strength. But even this 1 have not unfrequently found insufficient

from the state of debility to which a residence in this country had reduced the constitution of the person.

The periodical nature of the majority of the diseases of this country renders a repetition of the bleeding necessary, as the symptoms return with equal violence in 5 or 6 hours, and will be again relieved by the same evacuation, &c.; for this reason large quantities of blood are often abstracted. This should be avoided by employing the tartrate of antimony. For this purpose, immediately after bleeding grain doses of the tartrate of antimony in water sweetened are to be repeated every 6 hours till the 6th dose, when if the symptoms are not very urgent the patient is to be allowed to remain at rest for 6 or 7 hours. Should the disease be severe, the above dose is to be continued until the symptoms diminish. By the first dose vomiting and purging are often produced; but as the remedy is persevered in, these symptoms disappear, when the dose may be increased. The best effects are always obtained from the tartar emetic when neither vomiting nor purging is produced.

Mercury is another medicine which is employed with the best effects in inflammatory diseases after bleeding. In these cases, like antimony it must not produce its purgative effect, but seems to owe its beneficial effects to other unknown causes. It is probable that it acts by the debility it produces, and by its powerful influence in exciting the capillary vessels, and thus increasing the excretions and secretions of the body. When given for this purpose, small doses of opium are used with the calomel, and repeated every 4 or 6 hours, so as to produce its constitutional effects as soon as possible. This is obtained in most cases with some difficulty, and in other very severe and generally fatal diseases it cannot be produced. For obtaining the full effect of calomel it is not enough to produce ptyalism; this must be continued for some time after it has been accomplished before the good effects are apparent.

The powerful influence of mercury in checking inflammation is beautifully seen in Iritis; in which the disease ceases, and the secreted lymph is absorbed, as soon as the system is affected; and we find it equally efficacious in removing hard swellings left by inflammation in parts. Hence compound calomel pill may be very useful in elephantiasis or chronic phlegmasia alba dolens.

The delay which the employment of mercury implies, for the

production of its good effects renders it of much less benefit than the tartrate of antimony, which is therefore in most cases preferred.

The great advantage of these remedies is, that we remove the disease without weakening the constitution very much, and thus rendering the covalescence very long.

Purgatives with other evacuant remedies should never be neglected during the treatment of severe inflammatory diseases.

The sedative effects of *cold* may often be employed with advantage in the inflammatory diathesis. For this purpose it must be applied of a considerable degree of intensity. So great is the power of cold, that it may produce such a degree of debility, as will be followed by mortification when the inflammation is slight; but the coldness may be increased in proportion to the natural vitality in the part, and the degree of the inflammation.

Opium diminishes both local and general irritability, and may be used with great advantage in inflammation accompanied with much pain, especially when employed after blood-letting in irritable habits. For this purpose the dose should be large so as to ensure the full sedative effect. In these cases it seems to act by preventing the drain on the nervous system, and by checking the increased sensibility before it produces exhaustion. It always prevents the renewal of the excitement and pain, and induces sleep and perspiration, allows time to nature for repairing the waste, and may be repeated after each evacuation.

The indications for the treatment of inflammation will vary somewhat with the tissue affected. When a serous membrane is inflamed, more blood may be withdrawn than when the parenchyma of an organ, the cellular tissue, or a mucous membrane is inflamed, probably from the different functions of these several tissues; which require a larger proportion of blood, according to their importance and anatomical structure. The severity of the attack may be so great as to weaken the whole powers of the system, in which case the pulse becomes so weak that the practitioner may be led to suppose tonics and not bleeding to be indicated, although bleeding is the only remedy on which reliance can be placed. Such cases are best detected by means of the stethescope, which enables us to discover the cases in which the action of the heart is more energetic than that of the

arteries, when bleeding may always be employed with great benefit.* When the heart and pulse are alike feeble, blood-letting will generally produce a state of complete prostration.

Degree of violence of inflammation.—The hardness and frequency of the pulse, the influence of former bleeding on the system and pulse, the buffy coat, the quantity and particularly the toughness of the crassamentum, and the activity of the vital powers of the system, are the signs which guide us in taking blood. So much depends upon the shape of the vessel into which the blood is received, and the state of the system, in the production of the buff upon the blood, that it is not always to be alone considered as a proof of the necessity of bleeding. In most puerperal diseases, in rheumatism, &c. it is generally present. A much better criterion is the size, hardness, and cupping of the clot, and the small quantity of cruor compared with the serum which will be found to be in proportion to the sthenic diathesis of the individual; softness of the crassamentum indicates an opposite state of the system, in which bleeding will be found generally prejudicial. When the vital powers are weak, when the part affected is at a distance from the heart, in old or irritable habits, local bleeding should be preferred to the general loss of blood, so as to avoid the great permanent weakness which general bleeding is liable to produce. To avoid such a consequence, we must examine the state of the pulse, which if quick and hard indicates the advantage of bleeding, and the formation of the buffy coat; although the same change in the pulse may take place from a slight cause in an irritable habit of body. When the pulse is small, frequent, and hard, with acute local action, and little real power, local bleeding is to be used, and repeated according as it is borne, or the symptoms require it.

Another indication of bleeding is the small quantity and high colour of the urine: abstraction of blood is to be avoided when the urine is copious and pale.

During the treatment of inflammatory diseases, the food should be bland, light, and in small quantities, when the patient has an appetite, and only in the form of drinks when there is no inclination for food.

* Laennec, De l'auscultation, tom. 1. pp. 486 and 487.

In the treatment of internal inflammation the same principles are to be observed, but the above remarks will enable us to understand the reason why external inflammation is sometimes produced artificially, in order to diminish the local sthenic state in an internal and more important organ. In order that the external inflammation may produce this effect, it is necessary to recollect that the new inflammation must be produced at such a distance from the one it is intended to relieve, as not to increase the irritation in the part, or of the system which is in a predisposed state to such an effect. I have often seen the necessity of recollecting this principle in the use of counter-irritation for the diminution of internal inflammation. In one case that came under my notice a few years ago, a physician ordered a large blister to be applied over an inflamed caput colli before the inflammation had been sufficiently reduced. From its proximity to the disease, and the blood being supplied by branches of the same vessels, such irritation was produced that the blister rose in three hours, and increased the disease so much, that it ultimately proved fatal. In all such cases the inflammation should first be diminished by evacuants, before counter-irritants are used.

The distance at which counter-irritants are to be applied from the diseased part will depend on the degree of inflammation and the nature of the organ. In diseases of the brain, larynx, eye, &c. the inflammation is first to be reduced, and then the irritation is to be applied at some distance from its seat.

Stimulants, rubefacients, and blisters, are often useful from producing a derivation to the skin. In other cases purgatives, emetics, &c. may be used for the purpose of deriving to the bowels. These remedies either increase the healthy action of the tissues or irritate them, in either instance increasing their natural secretions.

In the application of counter-irritants it is of importance to modify them according to the tissue affected, and the stage of the inflammation, for the cure of which they are employed. When accidental, a simple counter-inflammation should be produced. If such an inflammation affects a serous sac, a blister is the proper remedy, as it particularly affects the extreme vessels which, by sympathy, act on the secreting vessels of the affected serous membrane. When the inflammation has passed to the stage of suppura-

tion, an issue is the most certain remedy; when ulceration, as of the cartilages of a joint, has ensued, a caustic issue will be most useful; in the caries of bones, especially when suppuration has occurred, caustic issues are also useful. Such remedies will be of more use in inflammation of the fibrous structure of the cornea and sclerotic, than blisters are when employed as counter-irritants in inflammations of the mucous membrane or conjunctiva.

There are several mixtures of medicines which, by possessing stimulating and antispasmodic effects, may be applied with great advantage to the neighbourhood of inflamed parts. I can recommend the following as an admirable procedure for inflamed eyes, having frequently used it with the best effects. In an attack of this disease, I once asked an experienced surgeon to recommend me what to do. He advised general or at least large local bleeding, a solution of lunar caustic, purgatives, and an avoidance of much light and using the eye. As I was deeply engaged in study at the time, I thought these conditions very hard, particularly as I knew the necessity of avoiding the abstraction of much blood in such an inhospitable climate as that of Bengal. The following compound, from which I had before derived much benefit, was therefore immediately applied, and in a few hours the inflammation was completely and permanently removed. The compound is formed by mixing equal parts of alum, opium, and rusweet, or the extract of the root of amomum anthorhizum (Roxb.) in a little water and applied round the eye. *

CHAPTER VIII.

TYPE OF INFLAMMATION.

Having considered the general nature, course, terminations, and treatment of inflammation, it is requisite to observe, in the next place, its varieties. These will be considered according to the peculiarity of the cause, which in one case is local or accidental, and in a second is inherent in the state of the system, which produces

* This is a native Receipt.

In the treatment of internal
are to be observed, but the ab'
derstand the reason why
produced artificially, in ord
in an internal and more
ternal inflammation me
recollect that the nev
distance from the or
the irritation in the
state to such an e
lecting this pr
diminution of
my notice a
applied ov
been suff
the bl
irrita'
cre
al'

'n of the p ... to
atic ; this third
'iar symptom

heir na'
ue.
-tj
.o consi.
..eady made have em-
, the chronic form of this
che state of the system, will be
..r the head of symptomatic inflam-
specific inflammation, will include pe-
..ations.

..n extends over all parts of the body, and per-
..portant and varied offices, we must expect to find
..e differences in the symptoms, effects, and consequences
..d by the same disease, according to the organ and tissue
..cted. These important distinctions were first pointed out by
Dr. Carmichael Smyth, * improved by M. Pinel, † and developed
by Bichat. ‡ The arrangements of the tissues, as recommended by
these able pathologists, have been improved by subsequent writers.
That which appears to be most convenient, and best adapted to the
present work, is to divide them into Tegumentary, Cellular, Fibrous,
and Nervous Tissues, which will decide the different genera of
each of the orders of this class of disease. Inflammation presents
other less important varieties, which depend on the use of the part,
the nature and intensity of the cause, the sex, age, and tempera-
ment of the individual, the seasons, and climate; all of which re-
quire to be recollected in the treatment.

* Med. Commun. vol. 2. p. 196, (1790.)
† Nosographie Philosophique, pr. edition, (1797.)
‡ Anatomie Generale, (1800.)

the veins; the same changes
duced, as when phlebitis is

Accid

·lwa/

this form.

.e previous part of these

this type of inflammation occurs mo..

..ic, may always be produced by certain mech...

...ical causes, which increase the vitality, and is as certainly
by remedies which reduce the tonic state of a part. These results
are, however, varied by other peculiarities, which would require
a more particular description, were it not that it is only the larger
features of the class of inflammatory diseases that are now at-
tempted.

This accidental or healthy inflammation is produced by an evident
external cause applied to a part, and affects one or more conti-
guous tissues at the same time; it rarely extends to any distance;
when severe, it is accompanied with fever, and the vitality of the part
is increased, particularly that of the blood. *Phlegmon*, or the accident-
al inflammation of the cellular tissue, may be taken as a specimen of
this order. When a part of the cellular tissue is inflamed, numbers
of vessels are affected, and their office of secretion and absorption are
deranged; this happens more particularly to the absorbents, which
being filled up by consolidated blood, do not remove the coagulable
lymph, which in the state of inflammation, is secreted by the arteries
into the cellular tissue. In such cases, the symptoms of inflammation
are strongly marked; the redness is vivid, heat considerable, the pain
acute, and the throbbing and swelling of the part are great, with
more or less of fever according to the extent and individual circum-
stances of the case.

As the part is not predisposed to inflammation, the disease has a
strong tendency to resolution; or if the cause be severe, to a deposit
of lymph, and an adhesion of the surrounding parts, so as to separate
the healthy from the diseased parts, which suppurate. This order
only terminates in gangrene when the cause is very severe.

a local effect from a weakness or predisposition of the part to inflammation may be called internal or symptomatic; this third variety is peculiar or specific, and produces peculiar symptoms and results.

These types differ so much from each other in their nature, that two of them cannot exist at once in the same tissue. They also differ in their course and consequence, and in particular in the treatment. These peculiarities have induced me to consider them under three heads or orders. The remarks already made have embraced the acute forms of inflammation; the chronic form of this disease, which is always kept up by the state of the system, will be more properly considered under the head of symptomatic inflammation; and the third, or specific inflammation, will include peculiar forms of inflammations.

As the circulation extends over all parts of the body, and performs most important and varied offices, we must expect to find considerable differences in the symptoms, effects, and consequences produced by the same disease, according to the organ and tissue affected. These important distinctions were first pointed out by Dr. Carmichael Smyth, * improved by M. Pinel, † and developed by Bichat. ‡ The arrangements of the tissues, as recommended by these able pathologists, have been improved by subsequent writers. That which appears to be most convenient, and best adapted to the present work, is to divide them into Tegumentary, Cellular, Fibrous, and Nervous Tissues, which will decide the different genera of each of the orders of this class of disease. Inflammation presents other less important varieties, which depend on the use of the part, the nature and intensity of the cause, the sex, age, and temperament of the individual, the seasons, and climate; all of which require to be recollected in the treatment.

* Med. Commun. vol. 2. p. 196, (1790.)
† Nosographie Philosophique, pr. edition, (1797.)
‡ Anatomie Generale, (1800.)

ORDER I.

Accidental Inflammation.

Inflammation can always be produced by a certain degree of irritation applied to a part; by which there is an exaltation of its proper tonic state. This form has been taken as the type of inflammation in the previous part of these remarks; by which it appears that this type of inflammation occurs more frequently in the plethoric, may always be produced by certain mechanical or chemical causes, which increase the vitality, and is as certainly cured by remedies which reduce the tonic state of a part. These results are, however, varied by other peculiarities, which would require a more particular description, were it not that it is only the larger features of the class of inflammatory diseases that are now attempted.

This accidental or healthy inflammation is produced by an evident external cause applied to a part, and affects one or more contiguous tissues at the same time; it rarely extends to any distance; when severe, it is accompanied with fever, and the vitality of the part is increased, particularly that of the blood. *Phlegmon*, or the accidental inflammation of the cellular tissue, may be taken as a specimen of this order. When a part of the cellular tissue is inflamed, numbers of vessels are affected, and their office of secretion and absorption are deranged; this happens more particularly to the absorbents, which being filled up by consolidated blood, do not remove the coagulable lymph, which in the state of inflammation, is secreted by the arteries into the cellular tissue. In such cases, the symptoms of inflammation are strongly marked; the redness is vivid, heat considerable, the pain acute, and the throbbing and swelling of the part are great, with more or less of fever according to the extent and individual circumstances of the case.

As the part is not predisposed to inflammation, the disease has a strong tendency to resolution; or if the cause be severe, to a deposit of lymph, and an adhesion of the surrounding parts, so as to separate the healthy from the diseased parts, which suppurate. This order only terminates in gangrene when the cause is very severe.

When numerous vessels are affected, or the constitution is so weak as not to throw out the quantity of lymph needful to define the inflammation, it sometimes extends along a considerable surface, and becomes very dangerous, by the ravages it commits in the cellular tissue. The free incisions into parts affected with phlegmonous Erysipelas, as recommended and employed by the bold and judicious O'Halloran, * since followed by Mr. C. Hutchinson, and modified and practised with much success by Mr. Lawrence, have often afforded me an opportunity of examining the state of the cellular tissue when inflamed. In these cases, the following appearances were observed :

1. An enlargement of the capillary vessels, more especially the veins, and their distention with dark blood. In such cases, large evacuation of blood followed the incisions, without producing that dangerous weakness, if not fatal collapse, which the enfeebled state of the person might lead us to suppose would take place. I have witnessed such an evacuation happen with impunity in pregnant women, which, under other circumstances, would have produced abortion. This fact is explained by the blood in such cases filling the veins, in which it is either stagnant, or moves so slowly as to undergo imperfectly the natural renovation in the lungs to fit it for use in the system. In such a state, the blood has little effect on the animal economy ; as it may be said to be out of the system ; it even seems to produce prostration of strength ; the circulation is in fact impeded, and is improved by the irritation of the part being diminished, and the equilibrium in the vessels restored ; by which means the circulation is carried on in a more natural manner. It is for a similar reason that large quantities of blood may be removed from veins in a varicose state, without that debility following, which, under other circumstances, would be produced.

2. The capillary vessels in the inflamed part are found distended with consolidated blood, which produces a venous congestion in the neighbourhood. As the disease advances in extent and violence, portions of the consolidated blood and neighbouring parts soften, and are converted into pus, which mixes with that secreted by the inflamed arteries, and forms abscesses. When the disease is very

* See his excellent work on Gangrene and Sphacelus, Obs. 28. p. 93.

severe, the inflammation extends along the veins; the same changes then take place, and the fatal result is produced, as when phlebitis is the primary disease. It is a fortunate circumstance, that the larger veins are affected by inflammation with much greater difficulty than the smaller branches ; the trunks contain a much larger quantity of the vital fluid which resists inflammation, or the change into a consolidated state, more powerfully, than the smaller branches, in the more highly organized vessels.

3. The inflamed cellular tissue is distended with coagulable lymph, mixed with limpid serum, and blended with red spots of blood. This secretion forms the principal part of the swelling, and is contained in the intersections of the cellular bands and sacs, which lie between and separate the depositions of fat. When the inflammation has advanced further, the gelatinous matter is changed into a hard substance, of a yellowish colour, which becomes less vascular, and more friable, and takes on a pultaceous appearance. The softening increases, and the cellular tissue breaks down until the numerous small portions of pus unite, and at length form abscesses, which contain shreds of the disorganized cellular tissue, and are surrounded by the same tissue, vascular, thickened, and condensed, which becomes lined with a sac, and has many of the properties of a mucous surface.

Inflammatory Fever.

When inflammation is severe in a part, or it involves an important organ in the animal economy, the heart and vascular system participate. The surface of the body becomes hot and dry; the respiration frequent and hurried ; the pulse full, hard, and frequent ; the tongue white and dry; there is considerable thirst; the secretions are diminished and depraved, and the organic functions impaired, particularly those of nutrition, so that coagulable lymph is not deposited by the secreting vessels. As the fever advances the patient becomes restless, and complains of headache, which sometimes terminates in delirium. These symptoms constitute what is called *Symptomatic or Inflammatory Fever*, which declines sometimes before, in other cases after, the disappearance of the local affection.

This is the most simple form of fever; and when its progress is carefully marked in different cases, it is found, precisely as in differ-

K

ent varieties of continued fever, that the quickness of the pulse, and the increased heat of the surface, are always present. These two constant symptoms are the consequence of unknown causes acting on the blood; increasing the velocity of the circulation, and augmenting animal heat. Hence the proximate cause of fever would appear always to act as a stimulus, by increasing the action of the heart, and the functions of the vascular system. When the fever is caused by a local inflammation, the stimulus is local, and its first effects appear to be produced locally on the circulating fluid and nerves of the part, from which the effect is propagated to the general system, particularly the heart and arteries. The unequal distribution of the blood, and temperature, &c. approach to those of inflammation; while other organs of the body are in a state of collapse. This is more marked as the inflammation is more severe and internal; in which case the collapse is sometimes general, and the surface of the body is cold and covered with a clammy sweat, which is produced by a vital transpiration, and is not a simple physical transudation, or evaporation from the part.

When the blood is examined, it is found changed in its quantity and quality, at an early stage of the disease; which shows that one of the first effects of the exciting cause of fever acts on the blood; increasing the size and consistence of the cruor. Such a change in the blood has been already noticed as being produced by an increased vitality of a part augmenting the action of the heart and arteries. This rapid circulation increases the sensible heat of the body generally, as we have seen it locally, when a part is inflamed. As the system is not affected for some time after the appearance of the local disease, so the buffy coat is rarely seen in the first stage, or until the disease has continued for some time. When the crassamentum is small, soft, and of a bluish colour, without any appearance of the buffy coat, little advantage will be derived from venesection, unless it be used as a preventive against fever that is expected to occur.

Local inflammation does not always produce a proportionate degree of fever. Thus in strangulated hernia the dull pain, the small, hardly perceptible pulse, and the weak respiration, are the most characteristic symptoms; and unless relief be speedily obtained by an operation, mortification takes place, and the person dies without any acute inflammatory symptoms.

The fatal result of symptomatic fever may be produced by the constitutional consequence, or the local effect; and still more frequently by the combination of both.

The indications of cure are to diminish the excitement by rest in the recumbent posture, a regulated temperature with ventilation, simple farinaceous food, cool drinks, and sponging the body with tepid or cold water; if severe by the abstraction of blood, and, for restoring the secretions to a healthy state, by gentle aperients, varied according to the peculiarity and intensity of the symptoms.

ORDER II.

Symptomatic Inflammation.

This order of Inflammation is not produced by an external evident irritation, but by internal and often obscure causes; such as derangements of the stomach, the depraved or irregular action of certain vessels, the influence of climate, &c. Such inflammations are preceded by more or less symptomatic fever, which is of a low irritable nature, and has remissions, and nocturnal exacerbations. It usually attacks the weak and unhealthy rather than the strong; affects one tissue, and often spreads in it to a considerable extent, and not unfrequently passes from one part of the body to another.

These changes of position do not always follow in the same kind of tissue; but in virtue of a peculiar sympathy which exists between different parts. These require to be considered, as they become more evident when they are exaggerated by disease; and often enable us to find out the best means of preventing and curing this class of diseases.

The stomach has the most extensive sympathy with all parts of the body. The general wants of the system, by occasioning the sensation of hunger, cause the person to become sullen and silent; but a crust of bread, or a glass of wine, will produce cheerfulness, even before the nourishment has had time to reach the general circulating system. The fatal effects suddenly produced by a blow upon the stomach, or a draught of cold water when the body is heated, prove the importance of this organ to the system. When a part is hurt, it affects the stomach more or less according to its severity,

the importance of the part injured, &c.   In irritation of the kidneys, the pain and vomiting are sometimes so great as might lead to the supposition that the disease was gastritis.   This influence extends to mental emotions, as proved by the effects of good or bad news upon the appetite.

The intimate sympathy between the vital energies of the brain and the stomach, the whole cutaneous circulation and other parts of the body, are other examples of such connexions.   As the view of suffering in another leads us to endeavour to alleviate it; in like manner the body sympathizes more or less with local disease, according to the importance or sensibility of the part implicated.   The derangements of the biliary secretion produce lowness of spirits; sympathetic fever, and lock-jaw, are produced by local injuries; chorea sancti viti is generally produced by disordered secretions of the abdominal viscera; and epilepsy is often caused by worms in the intestines.

All the functions of organs have a sympathy with each other, but this varies in different organs, and individuals.   In one person it is the brain, in another digestion, &c. which preponderates, according to the greater or less activity of the organs in health or when affected with disease, when the most obscure sympathies become apparent.   As the general sympathy may affect a particular part, and the general system frequently sympathizes with the part affected, any one of the organs may thus become the cause of a general irritation of the system.   The genital organs, and the functions of the brain, are familiar examples of such sympathies; while in fevers, these sympathies vary according to the nature of the disease, and the nature of the part that is particularly implicated.

The different tissues, which enter into the composition of organs, are affected by their peculiar stimuli, which excite them to perform their proper functions.   The different senses, &c. afford examples of such sympathies.   The approach of aliment to a hungry person increases the flow of saliva; the irritation of light acts on the retina causing it to contract duly for distinct vision; the pregnant uterus is accompanied with an enlargement of the mammæ, &c.

Hunter has called that sympathy continuous, when neighbouring parts sympathize with local injuries.   The reciprocal reports of the different parts of the digestive organs afford an example; as

is observed in the more or less good or bad taste of food, which prepares the stomach to receive or reject it. The irritation at the orifice of an excretory duct increases the action of the gland; worms in the intestines produce irritation of the nose; and a calculus in the bladder produces irritation at the extremity of the urethra.

Analogous structure and functions have an intimate relation to each other; thus when one part, as the eye, is inflamed, the other organ is very liable to be affected. When rheumatism attacks one joint it is liable to affect others.

These remarks on the different sympathies will prepare us for the peculiarities in the course of some of the species of this order of inflammation.

Whatever has a tendency to disorder the general powers of the system, so as to produce a certain degree of permanent weakness, or of change in the vitality of a part, has a tendency to produce symptomatic inflammation : such as bad food, intemperance in drink, impure air, hot and unhealthy climates, severe exertion, mental depressions, evacuations, &c. In this manner the eyes, lungs, &c. are inflamed by the local debility produced by a division of the nerves supplying these parts ; or by the action of sedatives, when applied to parts weak and easily deranged. The exposure of the extremities of the body to severe cold is succeeded by a powerful reaction, which sometimes terminates in the consolidation of blood and inflammation.

In other cases this tendency to gangrene and inflammation in weak parts is increased by causes impeding the circulation, continued pressure upon weak parts, during the course of long and debilitating diseases, such as typhus fever, &c., terminates in gangrene or sloughing of the parts, which stimulates the blood-vessels and absorbents in the neighbourhood, by which inflammation and ulceration take place round the compressed part. In such cases the part round the eschar appears of an undefined livid red colour.

Another class of exciting causes producing symptomatic inflammation, is such as increases local determinations of blood, such as previous attacks of inflammation in a part; this has always a tendency to extend itself, as the blood becomes affected in the analogous tissues, or parts previously diseased. In other individuals the causes operate more powerfully, or on certain organs more than

on others; as heat affects the liver and bowels, sudden exposure
to cold, particularly when combined with moisture, affects the air-
passages, &c.   The tissues most liable to be thus sympathetically
affected are, first, the serous sacs on the same side as that affected;
and in others, the serous sacs of the opposite side of the body.   The
brain and spinal marrow, the alimentary canal, the lungs, heart, and
skin, are likewise liable to be thus sympathetically affected in the
order in which they are mentioned.

Other causes of this form of inflammation act at a distance from
the part affected, as cold of the feet producing inflammation in the
throat, &c.   When the body is perspiring, or when there is an
unusual determination of blood to the surface, a sudden application
of cold is apt to produce internal inflammation.

Mental emotions powerfully affect capillary vessels in producing
local congestions, as in blushing, in the secretion of tears, &c.   In
other cases this influence of the nervous system upon the circulating
fluid may be so considerable as to produce disease.   In such cases
the first effect is on the tissue of the vessels, and then upon their
contents; and it may be so weak as only to change locally the balance
of the circulation.   The degree of this effect will depend upon
the sensibility of the part, and show itself when severe, by local
increased action.   The heat, sensibility, and irritability of the part
are increased, and the quality and quantity of the blood are changed;
and, like the secretions, become more copious and consistent.
In this state the part implicated possesses more vitality.

Such changes will be more readily allowed when the influence of
the nerves upon the vessels and their contents is considered.   Du-
puytren found that the division of the eighth pair of nerves pre-
vented venous blood from being changed into arterial blood: drawn
from the carotid artery, deprived of a portion of its fibrin, injected
into the veins of another animal, as a horse, this blood produced gan-
grene.   By the division of certain nerves, the organ they supply
inflames.   Magendie has proved this in the case of the fifth and eighth
pair of nerves, the division of which produced inflammation in the
eyes and lungs.

Parts situated at a distance from the heart, those in which the
venous blood returns against its own gravity, heal more slowly than
parts in opposite circumstances; and long courses of mercury, and

weakness of any kind, leave a tendency to ulceration. In this manner ulcers frequently form in scurvy, which is liable to attack the cicatrices of former wounds. It is a similar weakness which inflammation produces in parts.

Symptomatic inflammation rarely attacks two parts near each other at the same time; but a part in a neighbourhood may acquire a greater susceptibility than the part affected, and there is often a sudden suspension of the disease in one part, and a development of it in other parts, particularly in analogous tissues and organs holding a relation of dependence upon each other. This is called metastasis. Such translations are most common in the form of congestions; in other cases it is in the form of inflammations, and other morbid actions. In these cases the nature of the disease remains the same; as we find that it will return to the original seat on an irritating substance being applied to this; which causes it to leave the part secondarily affected.

An elderly gentleman was attacked with violent ear-ache, which returned every night about 7 o'clock, and was so severe as to prevent him from sleeping. In this case quinine was given with the best effects, and in a few days he slept well, and the ear-ache gradually diminished. He then felt the root of the nose extremely painful; it swelled, was red, hot, and very sensible; and in this state it remained for two days, when it suddenly recovered. He was now attacked early in the morning without any apparent cause with severe vomiting, which weakened him so much, that he supposed he was attacked with cholera, and believed himself dying. The vomiting was stopped, but he was left so weak and altered in appearance, and the stomach so irritable, that it could retain nothing. He remained for many hours in a state of the greatest prostration, expecting his hourly dissolution, which he supposed inevitable. He had an anodyne mixture at night, slept well, and next day though weak felt restored. The sudden translations of exanthematous diseases are also examples of metastasis.

During the time of transference there is often, says Dr. Holland, a well marked disturbance of the heart, of the nervous system, and of various organs, seemingly out of the ordinary course of disease, which disappear, when the symptoms are again locally fixed.[*]

* Med. Notes, p. 540.

In other cases the translation forms what is termed a critical termination of the disease; in which the inflammatory symptoms are often very slight, and a most peculiar secretion into some part is the most marked effect. Thus in phlebitis there is often found a deposit of pus in the synovial sacs; in other cases numerous deposits of pus in the substance of the liver take place after inflammation of the synovial membrane of the knee-joint, caused by opening it in order to extract a cartilage. In other cases dropsical effusions are sometimes rapidly translated from one part of the body to another; and as this sometimes takes place to the head, the metastasis may prove rapidly fatal.

This order of inflammation may be divided into the acute and chronic varieties. *Erysipelas* is an example of the acute form of this order of inflammations; in which the general disturbance is followed by an inflammation in the complicated, vascular, and very sensible structure of the skin. In this form, the inflammation is of a more livid colour, the heat and pain less intense, and the swelling trifling, in comparison with that attending phlegmon.

The derangement of the system is usually great, and the fever generally commences before, and continues after the disappearance of the local disease; it is likewise more of a low irritable nature, than that attending the first order of inflammation.

In this order *Symptomatic Fever* is produced by a more complicated cause than in the first or accidental order. Symptomatic fever may be produced by violent exercise; but in the former order it is produced by exposure to such a degree of cold as arrests suddenly the perspiration. In other cases it is produced by malaria. This form of fever is usually preceded by a cold stage, from an unusual distribution of blood, which produces languor, anxiety and debility; the limbs totter, the skin is cold, pale, clammy, and shrivelled; the features appear shrunk; the eyes lose their animation; and the secretions are diminished in quantity, and changed in quality. This is very evident in those of the mouth, and enable us to form an opinion of the degree and nature of the disease. When a crust of white mucus covers the dry tongue, it denotes a strong action in the vessels, and when the crust becomes more or less brown it indicates an atonic state of the system. After the initiatory symptoms have continued for some time, they are followed

by reaction, in which the pulse is strong, full, quick and bounding ; the skin hot, with throbbing pain in the temples, or a dull pain across the forehead and back ; the eyes are red and sparkling, with intolerance of light and sound ; there are frequent deep respirations, an insatiable thirst, irritable stomach, and a loathing of food ; the bowels are irritable ; urine red and scanty, and towards the termination of the disease deposits a large quantity of brownish sediment.

When a fever is severe, the pulse becomes smaller and more frequent, the tongue dry and brown in the middle, accompanied with great prostration of strength, coldness, restlessness and want of sleep, and delirium. The paroxysms of this fever increase at midday and towards night. It is produced either by local congestions or inflammation of organs, as proved by the symptoms, and by the increased size of the cruor of the blood.

The seat of this inflammation appears to be principally in the veins, and as the disease spreads rapidly in them, the obstruction of the circulating fluid in the part is considerable, and the redness diffuse. Where the cellular substance is in considerable quantity in the part affected, it participates in the disease, from the blood-vessels passing from it to the skin ; and by the consolidation of blood in the part, absorption is impeded, and an effusion of serum the consequence. This œdematous swelling is very evident, and is generally the first symptom observed when erysipelas attacks the neighbourhood of the eyes. In other situations the few secreting and absorbing vessels in the skin render the swelling less evident, while the obstruction in the numerous vessels produce bullæ, and vivid redness of the part.

When this inflammation extends to the neighbouring cellular substance, it forms phlegmonous erysipelas, which partakes of the peculiar symptoms of both the orders. Sometimes the erysipelatous inflammation extends over a large surface, and affects the general cellular tissue of the legs. This is often witnessed in females with bad constitutions, in whom the disease often produces œdema, mixed with a secretion of gelatinous or pultaceous substance into the part. This is sometimes followed by mortification of the extreme parts of the body, from the general and extensive obliteration of the veins, and the consolidation of their contents. When these patients have strong constitutions, nature separates the extreme parts,

where the circulation had stopped; but, in the generality of
these cases, death relieves the patients from their sufferings, before
such an effort takes place.

As erysipelas is principally confined to the veins, and attacks chiefly
those parts of the skin which are supplied with numerous capillaries,
as the face, neck, and extremities, it is more diffuse, and has less
of that adhesive character, which confines the disease to the part
affected in the first order of the class, and produces the swelling in
phlegmon, &c.

On dissection, the parts affected with erysipelas are found red,
infiltrated, and easily torn; when it proceeds to suppuration, it is by
small portions of the cellular tissue, and the consolidated blood in
the diseased veins being broken down, and converted into pus.
This is sometimes rendered evident by the evacuation of pus from
the diseased vessels. I have frequently found, on dissection, the
small branches of veins, in parts which had been affected with ery-
sipelas, filled with changed consolidated blood ; and in some parts
the vessels were broken down, and small abscesses thus formed, from
their connexion with the diseased cellular tissue in the neighbourhood;
in these cases, I conceive the fatal result is principally owing to the
effects of phlebitis.

Erysipelatous inflammation not unfrequently ceases in a part be-
fore it has run its course, and appears in another and distant part
of the body. These changes, or metastases, are sometimes favour-
able, at other times dangerous, according to the importance of the
part secondarily affected.

This order of inflammation sometimes terminates by resolution,
in other cases by gangrene ; from the extensive obliteration of the
smaller vessels destroying the circulation in the part affected.

The chronic from of symptomatic inflammation is of frequent
occurrence, and of great practical importance. It usually takes
place in persons who have had their bodies debilitated by long con-
tinued disease, by living on unhealthy food, in an unhealthy climate,
and in other cases by the improper use of certain medicines. Calomel
is the most frequent medicine producing such an effect, particularly
when the patient has suddenly exposed himself to cold and damp,
when under its influence.

Most chronic diseases are produced or kept up by that bad habit of

body in which a fulness of blood is produced, followed by a diminution of its motion. Intemperate and inactive habits enlarge the liver, derange the whole system, and render the person susceptible of disease; which may be experienced in different parts and tissues of the body at the same time.

When inflammation has occurred in a part, it leaves it in a state of weakness from the capillary branches having been unusually distended, and slowly regaining their natural dimensions and tone. On this account the curative means must be kept up, and the exciting causes of disease avoided so as to prevent its recurrence for some time after the symptoms of inflammation have disappeared.

Besides the acute and chronic varieties of this type of inflammation, there are others, which vary with the tissues affected. These, as we have seen, may be considered, 1st, According as it affects the integuments, cellular, fibrous, or nervous tissue, the organs of sense, and the parenchyma of organs. The second division is according to its general effects upon the system, which produce congestive and inflammatory forms of fever, which may, under particular circumstances, spread by contagion.

The *Treatment* of the symptomatic order of inflammations differs from that of the accidental. In the first form the exciting causes are first to be removed, and then their consequences. These indications point out the danger of evacuations in many cases, and the importance of removing the exciting cause. As this is most frequently constitutional, much care must be taken of the state of the digestive oragns and the general health.

Our first indication is therefore to remove the constitutional derangement which is keeping up the disease. Emetics will be of use in removing undigested food and bile; and then purgatives, tonics, and nourishing diet. Sulphuric ether in small doses, and antimony with camphor or nitre, will be of use, and combined repeatedly exhibited with calomel or rhubarb, as the case may indicate.

Local remedies are of much less consequence than in the treatment of the first order. In symptomatic inflammations the local treatment should consist in removing any local cause of irritation; as absorbing the irritating morbid matter which is often secreted from the inflamed surface, and by the employment of fomentations, anodynes, and antispasmodics. In some cases local bleedings will be

of use by removing the local congestion of blood which often keeps up the disease. In other cases these evacuations will do harm by the increasing weakness which they produce in the part.

A gentleman who had been many years in this country (India) consulted me on account of a sudden and very severe pain in the left side of the head and globe of the eye, which followed exposure to a cold current of air. The side of the face and conjunctiva of the left eye were swelled and red, with great intolerance of light, &c. and he complained of severe intermitting pain in the side of the head, but particularly in the globe of the eye. In this case warm soothing lotions to the eye, with quinine and aperients, removed all the distressing symptoms in a day, when he felt quite well. This intermittent inflammation, or rather congestion, I have seen of a more chronic form affecting the eye, in which a tonic and anodyne treatment was very efficacious, with attention to diet, and the avoidance of all irritating causes.

In other cases these attacks occur in persons whose general constitution is weakened by a residence in an unhealthy climate, which shows itself by the great weakness of digestion ; in such persons violent and long continued paroxysms of pain occur, often confined to one spot in the head. The above system of treatment is of great use in relieving the symptoms ; but change of air and to a better climate is sometimes found necessary.

Terminations. The constitutional cause often acts on a large surface, and from being less concentrated is more rarely cured by what was called the adhesive inflammation.

When the disease passes on to *suppuration,* nature in this order is less able than in the first form to bound the pus by adhesive inflammation, and purulent infiltration takes place into the cellular tissue. This is more frequently observed in the young and old. In other cases of debilitated individuals a caseous matter is deposited, which softens and forms an abscess.

In like manner symptomatic *ulceration* often proceeds towards a cure very slowly ; the ulcer is then said to be indolent or callous ; and the granulations which form upon the ulcer are large, soft, and require to be repressed. In other cases the ulcer increases in size, without the proper renovation or healing of the part, and forms the phagedenic variety.

Symptomatic Gangrene.—This form of gangrene is usually produced in the old and feeble, and often occurs in the course of severe febrile disease, as typhus, yellow fever, small-pox, measles, erysipelas, &c.   It may be divided into those of tissue, and organs.

Symptomatic Gangrene of Tissues.

1st.—As produced by diseases of the vascular system.   Under this head will be considered the species of gangrene caused by inflammation, which is supposed to produce this effect more frequently than appears to be the case ; as accidental or common healthy inflammation is a morbid action, set up by nature to defend and strengthen parts, and only causes their destruction when the constitution is extremely weak, or the exciting cause is very extensive and severe.

In such examples, gangrene is produced when a vital part is much excited beyond what is natural, beyond what its inherent powers are calculated to sustain.   Hence, gangrene is more liable to happen in proportion to the severity of the cause, and the vital weakness in the part ; and occurs most frequently in the extreme parts of the body, in weak individuals, or tissues.   But it seems improper to suppose that this effect is the consequence of inflammation, or " as standing in the same relation to it as adhesion, suppuration, or ulceration," for in general proper inflammation is absent, and is only set up to defend the constitution, and to complete the separation of dead from living parts.   The following are examples of this variety :

Case.—Mary Fraser, æt. 48, was admitted into hospital Nov. 16, 1826, with severe pains in both legs, to which she had been subject from time to time, without any apparent cause.   On admission she complained particularly of the right leg, which was hot and swollen; had a doughy feel, and her general health was much impaired.   Poultices were applied to the leg, and saline aperients, with antimony, administered in repeated doses.   Milk diet was allowed.

23rd.—The swelling, tension, and pain of the right leg were removed, and the general health improved.   A slight irregularity of the tibia was observed, supposed to be the effect of syphilis, for which blue pill and decoction of sarsaparilla were ordered.

28th.—Not quite so well ; complained of pain in the chest, particularly

in the region of the heart, pulse small and feeble; bowels very much relaxed.

Dec. 2*nd.*—Mouth affected with mercury.

5*th.*—Complained much of pain in the region of the heart; no rest ; diarrhœa continued.

8*th.*—Got no sleep, and cried out, from the severity of the pains in her limbs, and region of the heart ; pulse small and frequent, diarrhœa increased. The legs slightly swelled, and the point of the nose purple, which gradually became black.

Dec. 15*th.*—Slept much better, but continued very weak ; died the following day.

Nearly half of the feet and nose were found, on dissection, of a dark livid gangrenous colour. The intestines were in some parts inflamed, and in many places ulcerated. The lungs were generally diseased. The heart was large, and very flabby. Its right auricle was unusually firm, and on its surface black streaks appeared, of the colour of an old and very firm consolidation of blood, which was intimately interwoven amongst the musculi pectinati. The thickened portion of the auricle, when divided, was found to contain in its interstices a black fluid mixed with a solid substance, like melanosis ; a tumour of the same kind was found in the liver.

The veins of the pelvis were enlarged, knotted, tortuous, and filled with old consolidated blood. The femoral veins contained the same changed blood, adhering very firmly to their coats, which were thickened, red, and inflamed. In one of these veins the consolidated blood commenced under the termination of the saphena major into the femoral vein, which felt externally very hard and cord-like from the nature of its contents, and the increased thickness of its coats. The veins in the leg were found in the same state to their extremities in the toes. This consolidated blood was dark coloured externally, and ash coloured and very hard towards the centre. The femoral vein of the other leg was much reduced in size, and had the natural shining internal surface, with a number of membranous-looking septa dividing and giving it a reticulated appearance.

The gangrene in this case seemed to have been produced by the extensive obstruction of the veins, and cessation of the circulation in the extreme parts of the body. M. Ribes, the well known anatomist and pathologist, has noticed these changes in the blood in cases of erysipelas, and explained them by the weakness of the vessel acting

with difficulty on the fluid it contained, which stagnated, stopped, and hardened.* This explanation of these appearances is not peculiar to M. Ribes, but it is at variance with my experience.

In the above cases, and in general in erysipelas, the consolidated blood extends to a greater extent than in accidental or healthy inflammation, for the same reason that in an individual of a weak and unhealthy habit of body, inflammation from injuries is more diffuse; whereas, in the healthy, it is local, and is cured quickly, although the constitution be in a more sthenic state than in the first instance. Such a remedial power constitutes the vis medicatrix naturæ of Dr. Cullen, the vis insita of Haller, &c. In both the healthy or defined, and the unhealthy or diffused, forms of inflammation, the consolidation of blood takes place in that part of the vessel which has the highest vitality, which being the capillary artery, produces by obstruction the various symptoms of inflammation, as redness, heat, throbbing pain, and swelling, when the part is strong, and the cause acute. But, when this is more chronic and symptomatic, as in erysipelas, the consolidation of blood will likewise take place in the more highly vital capillary arteries, and, as the cause is more diffuse and less acute, the effort to overcome the obstruction will be more general, so that the blood accumulates over a large extent, without that swelling, hardness, and throbbing pain of phlegmon. The state of obstruction in the capillary vessels, and predisposition to consolidation of the blood being thus increased, a large portion becomes changed, and from the extremities, many of the arteries become filled, while others remain pervious, from the force of the circulation; and serum is secreted by them, which is not removed by the obstructed absorbent veins, and the accumulation forms vesicles, &c. In this manner we explain the appearance of dark redness in a gangrenous part, as the obstruction of the large veins prevents the return of the blood to the heart, which accumulates in the smaller veins, producing the redness and phlyctenæ. When the cause is less acute, both arteries and veins are so obstructed that the part retains a pale white colour,

* " Mais quelquefois la veine légèrement inflammée se laisse dilater et destendre par le sang. Ce vaisseau etant malade, ne peut que difficilement reagir sur le fluide qu'il contient, le sang y stagne, s'y arrete, s'y coagule, se durcit, se dissèche, adhere fortement, et fait corps avec la veine, alors la membre est plus ou moins enflée." Revue Medicale, 1825, p. 11.

and gradually shrinks and dries, as the absorbents remove the mois-
ture; just as it blackens, when the state of sphacelus occurs.

When the weakness is great, and the exciting cause acute, the
capillaries of a part may become so obstructed and diseased, as to
lead to its mortification, from the want of the circulating fluid in the
part. This will occur in patients in a bad state of health, as in
the case above related; and formerly, when the diet of the inha-
bitants of Europe was of an inferior description, and obtained with
great difficulty, such gangrenous appearances sometimes occurred
epidemically.*

Gangrene in such individuals is known by the pain abating, the
part losing its warmth, tone, and sensibility, and becoming dry and
black. When gangrene has proceeded deeper, the part becomes
soft, vesicles form on it, containing a red foetid sanies; and on the
cuticle being detached, it is known by the soft emphysematous
feeling, the want of sensibility, the smell and colour of the dis-
charge, by the diminution of inflammation, the appearance of ty-
phoid fever, and by the part becoming cold, black, and fibrous.

But, when the weakness produced by dissipated habits, old age,
an ossification or obstruction in the arteries of the extreme parts of
the body, or diseases of the valves of the heart, &c. causes gan-
grene, the extremities no longer retain their requisite vitality,
from the impeded circulation in, and nourishment of the part, and
one or more toes become affected without any apparent or very
slight external causes, and the affection extends to the foot, which
dies; in the same manner as an extension of the same cause in-
volves the general death.

This form of gangrene usually commences with a sudden attack
of more or less severe pain in the part or its neighbourhood, when
the person feels, and the part seems, in other respects, well;—this
pain is burning and shooting, and is much increased during the
night, and is sometimes accompanied with numbness, and coldness
of the part: a small pale green coloured spot may first be noticed
in one of the toes, over which the cuticle separates, and the cutis

† As in the erysipelas accompanied with sphacelus which occurred over
Europe A. D. 1090, and was known by the name of St. Antony's Fire. Sprengel,
Inst. Med. tom. 4. p. 225. Brunnerus, as mentioned by Morgagni, Epist.
l. v. a. 24.

underneath assumes a purple livid colour, which seems to be owing more to the obstruction of the venous blood, than to inflammation ; and the part feels cold, insensible, and shrunk in size, and soon becomes dry and black. In infirm persons the black spot has no appearance of redness round it, and is very slow in its progress. When more rapid, the part is less black and dry. In the former state I have seen it remain unaltered for several weeks, without any appearance of separation taking place ; and as this proves a great degree of weakness in the system and part, such cases are always dangerous, particularly when accompanied by an internal disease ; as its presence weakens still more the system, and hastens the fatal termination. Examples of such gangrene appear towards the termination of severe diseases which have weakened the patient very much, and always on those prominent parts of the body upon which it rests in bed, as over the trochanters, and os sacrum. This is readily accounted for by the pressure, in the debilitated state of the system, causing the death of the part; country people still form issues by pressing a pea upon a sound part, which causes absorption, and so the bed is formed. These sloughs occurring in the course of diseases from debility, are thrown off very slowly, and often endanger the life of the patient. When spots of gangrene appear upon the foot, where the vitality is greater than in the toes, or when the person is stronger, the surrounding inflammation has a more doughy feel than in phlegmon, and the redness is darker and more equably diffused than usual, with more or less vesication, heat, pain, and thickening. This is an effort of nature to separate the dead part; which is a black, soft, humid, and putrid mass. Such an effort cannot be considered as having any connection with the disease; which so often appears primarily without any of the symptoms that indicate the presence of inflammation.

In such a state of weakness, or in an opposite state, when the cause has been so severe that the efforts of nature are not sufficient of themselves to consolidate the blood, hæmorrhage is liable to occur, on account of the absence of the adhesive inflammation in the vessels, and tends of course to weaken the system still more.

As the cause is internal, the gangrene appears often in separate sloughs, and is accompanied or surrounded by large patches of dark uniform redness, where the vitality is considerable ; while other

L

gangrenous spots, at a greater distance from the heart, and where the
vitality is weak, remain stationary, and no effort seems to be made to
separate and throw off the dead part.   The burning shooting pain
is most distressing, particularly during the night, and produces symp-
tomatic fever, which takes on the character of the remittent,
the accessions occurring soon after noon, and before midnight.

The constitution is generally little affected in the first stage of
this form of gangrene; the pulse continues slow and weak, and it
is only when the disease has made great progress, or when the person
is strong, that it becomes frequent, weak, irregular, and sometimes
intermittent.

In this form, the red line, between the dead and living parts, is
less distinct, and the separation of these parts very seldom occurs
without the assistance of art.

CASE.—Lukee Narayn Mukergie, a Daroga aged 45 years, who enjoyed
good health though he lived a debauched life, while labouring under gonor-
rhœa, felt a burning pain in the outer side of the right foot, which termi-
nated in a sore from which some ill conditioned pus issued.   When I saw it,
three weeks after, it continued discharging, and the skin of the sole of the
foot seemed partially detached, pale, dry, and corrugated.   At this time
(21st March 1836) the upper part of the foot was much swollen, and of a
dark livid bluish colour, over which there were large phlectenæ, surround-
ed by vesicles.   On the side of the second and great toe were situated
round, black, dry, excavated sloughs of the size of a shilling, without any
appearance of surrounding redness, although tumid.   The foot was cold,
and the ankle hot, swollen, and very sensible; indicating an effort of
nature to throw off the disease.   For several days he seemed to be better,
the burning and shooting pain being much diminished by medicines.

23rd March.—The foot was generally œdematous, of a white colour,
and cold.   The gangrenous spots were increasing in size.

24th.—Complains of very severe burning and shooting pain in the foot
and ankle.   Skin separating from the foot, and a large black patch
appeared in the instep, surrounded by a dark redness.   The sloughs on
the toes remain quite stationary.   Pulse soft, and small, and feverishness
appeared in the afternoon and beginning of the night.   The abscess over
the ankle-joint opened, and a little blood and pus was discharged.

26th.—Complained much of pain which was particularly severe at night;
had a little disturbed rest; the patient appeared haggard and irritable;

pulse 112. There was a disposition to separation of the black spots on the instep. Slight hæmorrhage from the side of the foot, which continued, as long as I saw him, to discharge a few ounces of blood daily, when there was neither redness, nor adhesive inflammation. The slough in the toes continued the same.

30*th*.—Skin separated from the ankle, and a red uniform erysipelatous redness appeared over the abscess, which discharged a large quantity of ill-conditioned pus. The black patches on the side of the instep are slowly separating, so that the ulcerative process may be seen round the slough. Those on the toes continued the same, and, with the unhealthy discharge from the abscess, proved the weak state of the system.

In this case the usual remedies, as poultices with charcoal, chlorate of lime and camphor; the internal exhibition of mercurial aperients, opium, bark, &c. were exhibited, and varied without much marked advantage, and it became a question, whether or not amputation should be performed. His friends had been made aware of the dangerous nature of the disease from the commencement of it, and as he had not improved, while taking the usual remedies, amputation of the member seemed to afford the only chance of preserving his life, by removing the diseased part, and leaving a clean wound on a part in a higher state of vitality. He was haggard, weak, and irritable; and pulse irregular, small and 120; tongue clean; bowels regular. It was agreed that the operation should be performed, but on my next visit I found his friends had removed the patient to a distance, and now refused to allow the operation. I have since heard that this person died a few days after he reached his home.

In this case the disease continued without any appearance of inflammation, which had no connection with it, but appeared to be produced by a weakened state of the system, which could not nourish sufficiently the extreme parts of the body; in the same manner as when an extreme part is affected with cold, which first weakens, benumbs, and at length destroys its vitality. A system so weakened, has rarely sufficient energy to separate the dead part, and the disease terminates in death.

CASE.—Kolimuddeen, æt. 40, states, that two months ago a small slough appeared without any cause, between the middle and fourth toe. of his left leg, with a severe burning pain in the foot. The gangrene extended to the three small toes, which became black, and when brought

to the hospital the gangrene was found to have extended along the meta-tarsal bones of the three small toes, which were black, with a bad fester.

His bowels are as usual; pulse small and slow; burning pain of the affected part; lately he has slept badly from the gnawing burning pain. He has used several native medicines without any advantage. Wash and clean the parts with the chlorate of lime; linseed poultice, blackened with charcoal; sulphate of quinine gr. ½ ter die, blue pill gr. v. opii gr. i. at night; soup diet.

28th.—The sore has a more healthy granulating appearance, but the effort of nature is very slight, and as part of the black mass on the sole of the foot is not separated, a pledget covered with citrin ointment was placed along the edge of the sore, with the poultice over it. Continue the medicines as before.

Jan. 1st.—Slough detaching, and free suppuration taking place; still sleeps badly.

5th.—The three dead toes have separated.

13th.—As he complained of the weight of the poultice, it was discontinued over all the sore, which is contracting in size; the puffiness of its edges having diminished, they have a healing appearance. Several days ago he complained of severe burning pain in the small toe, and a black slough had extended for some distance along its side. This is now detaching, and the rest suppurating. Three grains of camphor and one of opium were given at bed-time; he slept much better last night. The result is unfortunately not recorded. I have every reason for believing that it was fortunate.

This form of gangrene is of very frequent occurrence among the natives of Bengal, and is called *Puschimaa*. For the cure they employ poultices, mixed with lime water; burnt blue-stone, &c., they seek to hasten the separation of the slough by the use of these stimulants. When this has been done, healing ointments are applied for promoting granulations.

When the severe nocturnal pains occurred in such cases of gangrene, the venous system was found peculiarly affected, and a consolidation filled up many of the trunks, indicating their state of inflammation. This occurring in a weak irritable state of the body may explain it, without supposing that a consolidation always takes place in an early stage of the disease. The cases above related prove that the veins are principally affected, and not the arteries, as M.

Roche and M. Sanson conjecture in their excellent work on Medico-Chirurgical Pathology.* What still further illustrates the pathology of this disease, is the hardness and frequency of the pulse in the more acute forms and stages, and the advantage derived from bleeding.

The predisposition which veins, in this state, have to inflammation, is another reason for hesitating to remove members attacked by this form of gangrene, unless in very favourable cases, and for the necessity of being most careful in diminishing, as much as possible, the causes of phlebitis. This fact is exemplified in the following case.

CASE.—John Reid, a strong bodied sailor 53 years of age, had his great toe crushed by a horse treading upon it. He continued to walk about, until the stinging, burning pain in the injured part prevented his sleeping, and obliged him to apply for assistance. The great toe was found of a white ash colour; this tinge extended up the foot, and insensibly terminated in a bright livid colour, which reached half way to the ankle-joint; this part, with the foot and leg, were all much swollen and œdematous, so as to pit, on pressure being made upon them. The ash coloured portion was quite insensible, and the cuticle was easily separated from the cutis. The severe stinging pain occurred in paroxysms, and was peculiarly distressing at night, producing a twitching and shooting pain in the leg.

The effervescing poultice was applied to the foot, an aperient was exhibited, and two grains of quinine were ordered every six hours, with six ounces of wine daily.

For several days the disease continued to extend, and the pulse of the patient became weaker, while his appetite and digestion continued good. He lost flesh, although taking powerful tonics; he had a more haggard look than when admitted into hospital, and as the disease slowly progressed, no line of demarcation forming. The leg was amputated under the knee. Six or eight ligatures were required to secure the bleeding vessels, several of which were veins, and blood continued to ooze during the night.

The stump took on an unhealthy appearance, and sloughs formed, with an unsound sanious discharge. The second day after the operation, his appearance became more haggard and reduced, and he died on the 19th day

* Tom. 4. p. 1044.

after the operation. On dissection the arteries were found extensively ossified. The saphena major vein was filled with pus, beyond which consolidated portions of blood separated the diseased from the healthy part of the vein. Several bursæ, and the hip joint, were filled with pus; the sack of the pleura of the left side contained a quantity of serum, and the lower part of the surface of one of the lungs was coated with recent lymph.

The following is a rare example of this form of gangrene.

CASE.—M. B—— æt. 40, of stout make and sanguine temperament, had been in India for 12 years. In Nov. 1839 he was attacked by an inflammation of the left eye, probably from using it too much, and not taking sufficient exercise. He soon got well; but on the 1st of January 1840 he was attacked with acute bronchitis, for which he was treated.

On the 7th he had an attack of epistaxis; and to-day he first noticed red patches upon his chest, which gradually extended to the trunk, face, and extremities.

Jan. 10*th*.—12 leeches were applied to the chest under the clavicles, where the redness was most vivid. At this time there was considerable redness, and a general swelling of the face and body. This extended to his mouth, and his tongue was so swollen that he could only swallow with difficulty.

15*th*.—A day or two after this, an abundant secretion of a purulent fœtid matter took place from all parts of the skin. This was followed by an abundant desquamation over the chest, hands, arms, and face. The cough continued. During the night he was slightly delirious.

16*th*.—The face discharged purulent matter of a fœtid smell; the eyelids were infiltered, and the left eye was again inflamed. The cough very distressing.

19*th*.—Leeches under the clavicle. From this time, cream of tartar was given daily; and mustard foot-baths to cause a determination from the head were used.

The suppuration has now extended over all parts of the body, particularly where the skin is bent, as in the axilla, &c.

20*th*.—From the 20th to the 25th the patient is weaker from several slight attacks of fever, which he supposes are caused by the coldness of the weather; and he remained in bed until a flannel dress was prepared. The bowels have been kept open, and changes of temperature are avoided,

fresh oil and Goulard's lotion were applied to the parts which are suppurating, in order to prevent too great a degree of weakness from the copious secretions.

21st.—Desquamation commenced in the inside of the mouth, which became so sensible, and the tongue so dry, as to prevent him eating solid food.

30th.—The patient is very weak by the copious suppuration, which begins to diminish. He feels well, and is anxious for his warm dress in order to enable him to return to his business.

Feb. 6th.—To-day he felt a severe pain in the left great toe, which is cooler than natural. Heat was in consequence applied with dry frictions and camphor-liniment; passed a very good night.

7th.—The patient felt very well. At midday he was placed in a warm bath; a quarter of an hour after, the burning pain returned with great violence, and he was taken out of the bath. Heat to the pained part, and frictions with the tincture of cantharides. The pain diminished in the evening, but returned in the night. The great and the other toes were pale and cold, while the rest of the body was red and hot. A small blister, the size of a crown-piece, was placed, at the urgent request of the patient, upon the great toe, and he was ordered to remove it as soon as he felt the pain diminish.

8th.—On removing the blister 12 hours after its application, the part was found black and gangrenous, and the half of the foot very cold. From 6 o'clock in the evening to 7 A. M. four grains of opium and three grains of camphor were given; frictions with the oil of turpentine upon the leg and foot, with the application of heat, were continued. Diet,—meat, soup, and wine and water for drink.

The night was passed without sleep on account of the great irritation of the skin, so as to oblige the patient to scratch himself continually.

9th.—The eschar of the blister has increased in size, enveloping the other toes and a part of the foot; but the cold did not extend beyond the ankle. The foot is swollen, and is of a violet colour. There is a sense of numbness in the part rather than pain. The pulse is feeble and frequent. The mouth is dry. Heaviness without any derangement of the head. Diet,—meat-soup, a mutton-chop, with wine and water for drink. Ass's milk during the day. Turpentine frictions continued, they are felt less than yesterday. Four grains of opium and camphor.

10th.—The tongue is better. Has neither had stools nor passed urine for 24 hours.

Soup, prunes, wine and water, with whey and nitre. Poultices of linseed, mixed with camphor and bark, were applied to the foot, and repeated 6 times a day. In 24 hours he took four grains and a half of opium and camphor.

To-day I first saw this unfortunate gentleman, and found the whole skin of the body dry, hot, very red, and desquamating. It was very itchy, so as to oblige him to be continually scratching. His mouth was parched with great thirst; he had no appetite; tongue brown in the middle, and clean along its edges, pulse small, hard and 120. His head was unaffected. All the toes of the foot were insensible, and black; and gangrene had extended along the instep half way up to the ankle. Its edges were pale, and no line of separation appeared. I recommended his not being forced to eat, to diminish the quantity of opium, and give it in the form of Dover's powder; to give an aperient, to continue the poultices, &c. and to be guided by circumstances.

22nd.—I afterwards was requested to see Mr. B. in consultation with his surgeon. We found the patient in a much better state. He said he felt quite well. The colour of the surface of the body was nearly natural, although the desquamation and itchiness continued.   The pulse small, soft, and 110; tongue clean, thirst diminished, appetite improved, and bowels regular. The toes were completely gangrenous, and sphacelus had extended to near the ankle, where the line of separation between the dead and living parts had commenced. The ulcerated surfaces were healthy, and some superficial gangrenous slough on the foot had separated, and the surfaces were peeling. Under these circumstances I considered the moment for performing the operation had arrived; and, having given the patient a dose of castor oil during the night, the leg was next day removed under the knee.

On dissection the muscles of the foot were found of a deep dark reddish colour. On cutting through the deep ulcers in the sole of the foot a quantity of dark thick very fœtid pus, which communicated with the metatarsal joints, was evacuated. This proved the necessity of the operation.

The stump healed up very well, though a small exfoliation of the bone retarded somewhat the cure. His health continues very good.

Debility sometimes acts as an exciting cause; as in the following cases, which also prove the importance of a generous diet in some forms of this disease.

CASE 1.—Surup Dass aged 49 was removing a brick wall five days ago, when it suddenly fell upon him and covered the whole of his body with the exception of his head. When he was got out, he fainted from the loss of blood from a large wound in the lower third of the leg, where the tibia and fibula were fractured. The bleeding could not be arrested by his friends, and he is said to have lost four or five seers of blood; and from the state of weakness, which the loss of blood had produced, his recovery was not expected. The wound was left exposed to the air, and when he was brought to the hospital, it was full of maggots, and the foot in a state of gangrene.

Tonics and stimulants were given freely, in the hope that if reaction took place an opportunity might occur of amputating the limb. But the weakness was too great for this, and he gradually sank, and died the same night.

CASE 2.—Henry Chapel, aged 46, was admitted into hospital with a large old ulceration on the leg which had been much aggravated by intemperance and walking. After remaining a fortnight in hospital, he was discharged, with the sore nearly healed. A short time after he again presented himself, and was admitted with dysentery, and the ulcer extending from the ankle to near the knee-joint, of a dark yellowish and sloughy appearance.

He was put on a suitable tonic diet, and charcoal poultice was applied to the ulcer, but he became very low from the dysentery; the remedies for which, seemed to have no favourable effect.

The extent and appearance of the gangrenous ulcer, with the state of weakness and delirium of the patient, induced the surgeon to amputate the limb above the knee, on the 30th August. A considerable bleeding proceeded from one of the veins, round which a temporary ligature was applied.

4th Sept.—Continued in a low irritable state, with occasional muttering delirium, and much annoyed with coughing. The stump looked flabby, and discharged a thin fœtid matter, for which yeast poultice was applied over strips of cloth, covered with the ointment of yellow resin, so as to accelerate the action of the part.

He gradually got worse, typhoid symptoms became more marked, and he sank on the 19th.

On dissection, the brain and mucous membrane of the intestines were found inflamed. The internal surface of the arteries irregular, thickened, and studded with ossific points. The femoral vein was contracted in its size, and firm consolidated blood filled it up from its cut extremity. This was in part softened, and mixed with a puriform fluid, proximate to which

firm consolidated blood filled up most of the abdominal branches of the vena cava ascendens, which at different parts of its course was tortuous.

The fatal termination in this, as in the former cases, seems to have been produced by phlebitis; to which the patient was predisposed by the bad habit of body.   It affords another example, to the many already on record, of the danger of applying ligatures even of a temporary kind to veins, and proves the caution required in forming a prognosis in this species of gangrene.

Mortification as it occurs in the cellular tissue.

This form of mortification is of frequent occurrence from the low state of vitality of the cellular tissue, and is diffuse, or circumscribed.

Diffuse mortification occurs most commonly in cases of erysipelas phlegmonodes, and in weak and unhealthy individuals, and unsound parts; of which the following is an example.

Case.—Dorah Michell, a servant aged 35, who had been long out of employment, and reduced by dissipated habits to the lowest state of penury, came to St. Bartholomew's Hospital, London, with several unhealthy sores on her legs, and nodes on her tibiæ.   She was much distressed with nocturnal pains in the limbs, her skin was hot, tongue white and dry, with loss of appetite.   By attending to her bowels, rest, and exhibition of sarsaparilla, &c. she got much better, and the sores healed up; but the cicatrices continued surrounded by a dark purple areola, which increased on the leg being allowed to hang down.   In this state she left the hospital.

Two months after the time of her discharge, she again presented herself during severe frost, with an erysipelatous redness over the left leg, which reached in two days to the groin.   An unhealthy abscess formed in the leg, the surface of which had a dark livid red colour.   The tip of the nose became of the same colour, and felt colder than the neighbouring skin.   She could not sleep at night, on account of severe pain in her limbs.   She felt weak and low, had no appetite, and her appearance was anxious and haggard; pulse almost imperceptible at the wrist, weak, and 148 at the heart.   The swelling of the left leg lessened, but the redness extended to the trochanter major.   The right foot and lower part of the leg had a dark

purple mottled appearance, and was icy cold, but this diminished with the redness. She complained much of shooting pain in her foot and knee.

The deep colour at the tip of the nose became more circumscribed, and the part colder. The weather continued very severe, and she felt it much, although well defended by clothes and warmth from its influence. Black sloughs formed over the left trochanter major, and the cuticle had a livid appearance, and separated from the foot; while the leg seemed somewhat warmer than natural, as if nature was endeavouring to separate the diseased part. Respiration became more difficult, and the woman died, three days after her second admission into hospital.

On dissection the vessels were found healthy, and the veins of the extremities filled with semi-coagulated or partly consolidated blood.

In this case bad food, exposure to the inclemency of the weather, and a constitution worn down by want, dissipation, and disease, seemed to have caused gangrene. Mercury had been taken largely, before admission into hospital, which necessarily produced a diminution of vital energy. The warmth, and nourishing food, caused reaction in the extreme, or weaker parts of the body; to which much blood was sent, and increased the tendency to gangrene, from the veins not being able, owing to their engorged state, to return the blood, which the heart propelled to the extremities.

Had this person been stronger, a more marked reaction would have taken place, followed by adhesion and suppuration; and the sphacelated part would have been removed. This example is similar to the one related by Dr. Huxham, in which on the 15th day of the disease the woman had exceedingly profuse sweats, her tongue grew quite black, or rather livid, and extremely dry. The day following, vibices, or large black spots, were discovered on several parts of the body; one in particular, on the tip of the nose, and another on the bridge of it; which turned quite black, as did a large blotch on each cheek, nearly of the breadth of a crown-piece. Her nails and hands grew very black and as cold as marble. An intolerable stench proceeded from her, at least forty hours before her death, though kept clean with all possible care.*

* On Fevers, p. 98. See Phil. Transactions for 1757, abridged edition, vol. 2. p. 159.

Such cases are more common than is generally supposed, and the appearance of the tissues and blood-vessels on dissection is less known in consequence of neglecting opportunities of examining such bodies, from a belief that nothing new is to be learned from them.*

Circumscribed Mortification of cellular tissue.

Carbuncle and *Boil.*—During unhealthy wet seasons, these diseases make their appearance, particularly in those exposed to the influence of the climate and weather ; in persons of delicate health who live on indigestible or unhealthy food; from various as yet unknown internal causes, or as the sequel of other diseases, as bad fever, &c. which produce indigestion, and general constitutional derangement.

Boils are of such frequent occurrence and are so well known, that I shall confine the following lines to a few remarks on carbuncle. This appears in parts of the body where the cellular tissue is most abundant, as upon the neck, back, shoulders, and thorax. The part affected has a feeling of heat and itchiness, which increases and becomes a painful burning, a circumscribed hardness may be observed in the part, increasing in size, and becoming more painful, and of an equable dark red or dull brown colour like a boil, but larger and flatter. The person feels much out of health, and has no appetite; complains of nausea and headache; is very weak, restless, and anxious; and has a small frequent pulse. This circumscribed tumour is enlarged, becomes of a livid blue colour, and swells; the centre of it changes to a grey colour, becomes thin, soft, and ulcerates; and a small quantity of thin brownish pus, mixed with blood, escapes with some cellular fibres; other small ulcerations form, increase in size, and unite, discharging the same red fœtid matter, mixed with fibrous sloughs. In the Hindoos the hard rounded, slightly elevated tumour is of a darker colour than the neighbouring skin.

---

* Je suis persuadé que c'est de cette cause que depend plusieurs gangrènes spontanées dont on a ignoré les causes, et par la repugnance qu'inspire l'ouverture des cadavres gangrènes, et par l'idée qu'on ne peut rien apprendre de nouveau de la dissection d'une partie dout la mortification s'est emparée. Dict. des Sciences Médicales, tom. 17, art. GANGRENE, p. 334.

This often opens by several apertures, from which a bloody fœtid discharge proceeds, mixed with sloughs of the cellular tissue.

When the disease is not very violent, the unhealthy swelling becomes bounded by a circle of red inflammation, by which the parts are separated, and large sloughs being discharged, healthy suppuration follows; the health mends, the apertures fill up, and an irregular cicatrix is left. In many of the cases of carbuncle the persons are old, or their constitutions debilitated by dissipated habits; in them the disease extends, the fever increases, and they die exhausted, the danger being determined by the extent and number of the diseased parts, and by the social position of the person.

This disease generally appears sporadically, although formerly it appeared epidemically in Europe, and was very fatal. In this country (India) the disease is frequently seen among natives, and from neglect, or improper treatment, often proves fatal.

The cellular tissue is the principal seat of carbuncle, and the extent of its ravages cannot always be known by the outward appearance of the superincumbent integuments, which, with the affected parts, sphacelate, as the disease advances. In the native, however, less skin is destroyed, as it is more vascular, and the powers of reparation are greater than in the European.

The local treatment of this disease consists in laying open and removing as much of the diseased contents as can easily be done; so as to apply remedies to the diseased part,—fomentations, and emollient poultices,—and assist nature in throwing off the sphacelated mass. This disease being produced by a constitutional cause, care must be taken to remove this state of the system by proper remedies, as emetics, and mercurial purgatives, with opium, to mitigate the severity of the pain; combating troublesome symptoms, keeping the air cool and pure, and using tonics.

In other cases, gangrenous circumscribed swellings of the superficial cellular tissue occur in malignant or gangrenous erysipelas; in the progress of scarlatina, or typhoid fevers; in injuries of the spine, &c. In all these cases the danger depends on the nature and severity of the disease, with which the gangrene is complicated; while the local effects, if severe, aggravate the constitutional disease, producing a low irritable fever, with chills, profuse perspirations,

and great prostration of strength, as in cases of idiopathic gangrene.

Chancres or buboes sometimes take on the appearance of sloughing from the very beginning, in consequence of the irritable and unhealthy habit of body. The painful itching of the part calls the attention of the patient, who finds a black spot, with considerable surrounding inflammation. The slough and inflammation augment so as often to require the division of the prepuce in the male, to expose the sores to the action of topical remedies.

This species of sore is not usually followed by any secondary symptoms of syphilis; most probably from the severity of the local inflammation and the animal poison in these highly vital parts, destroying the neighbouring parts. In these cases powerful antiphlogistic means are often required, in order to arrest the progress of the disease.

Mortification of the mucous tissue.

This variety of gangrene occurs in the mouth, throat, and intestines.

1. *Gangrene of the mouth.*[*]—This disease usually attacks the children of poor people, from the age of eighteen months, to that of six or seven years, during the cold season, when they live in confined, low, damp, unhealthy situations, on indigestible and poor food, and when attention to cleanliness is not observed. In such circumstances the disease may become epidemic. In such cases it is not preceded by inflammation; but an œdematous circumscribed swelling appears upon the cheek, with a central elevated point more or less hard, over which occurs a dark red spot. This may appear on the inside or outer side of the cheek. An eschar forms on the central point from within outwards, and slowly separates in shreds, mixed with a dark sanguineous fœtid fluid.

It often occurs in weak children, reduced by attacks of fever and spleen, in whom any slight irritation is liable to be followed by sloughing ulcers. This is peculiarly the case when the debility is increased by the use of mercury, the irritating effect of which upon

* Pearson's Principles of Surgery.

the salivary organs, and neighbouring parts, renders them peculiarly liable to terminate in gangrenous sloughs.*

A child two years old was attacked with spleen many months before I saw it, for which the usual native remedies were employed without any benefit. Gangrene of the mouth commenced two days before I was consulted. Two days after, it had extended to a great distance around, and in a week had destroyed the soft parts of the cheek, nose, and most of the forehead; leaving the bones covered with a dirty brown matter.

The margin of this frightful sore was pale, swelled and puffy, and a thick dark brown fœtid matter covered its border. The body was in a state of the greatest emaciation, but still the mental faculties remained unclouded until a short time before death. As this gangrene is the effect of the state of the constitution, local remedies have comparatively little effect in arresting its progress.

In some of these cases, the digestive powers are little affected; in others colliquative diarrhœa occurs with cerebral symptoms, hastening the fatal termination, which often happens from the third to the eighth day.

2. *Angina Gangrenosa.*—Dr. Fothergill has given the first good account of this disease; which, however, he seemed to have supposed was more common than it is found to be, from his having considered false membranes as gangrenous sloughs.† Huxham has fallen into the same error.‡ Angina Gangrenosa sometimes appeared formerly as an epidemic, and was peculiarly fatal among children and persons weakened by previous disease, or exposed to noxious damp air, and scanty food,—it very generally accompanied other dangerous diseases. It is now a much rarer occurrence from the superior manner of living, and attention to the comforts of life which so distinguish the present age. The disease commences with vertigo and shivering, succeeded by a feeling of heat, with pain and sense of tightness in the neck, a difficulty of breathing, an alteration in the voice, fœtor of the breath, and feverish uneasiness. These symptoms are always much aggravated during

* See Twining's Account of the Diseases of Bengal, p. 274.
† An account of the Putrid Sore Throat, by Dr. Elliot, p. 161.
‡ Diss. on a Malignant Sore Throat, p. 266. Lond. 1775.

the night, and are sometimes accompanied by nausea and vomiting, in other cases with diarrhœa or muttering delirium, from which the patients may be roused. The throat when examined is found more or less swelled, and of a florid red colour, with white or ash-coloured spots, which subsequently become brown, and black; the sputa are thin and bloody; in other cases, ulcers of a foul colour appear in the throat, with a fœtid peculiar breath. Symptoms of typhus fever accompany these symptoms, with petechiæ over the body; the pulse is small, quick, and sometimes fluttering, accompanied by great and sudden dejection of spirits and of strength. The face and throat often swell externally, and are œdematous. A fœtid acrid discharge takes place from the nose and mouth, and excoriates all the parts it touches; the difficulty of breathing increases, and is succeeded by restlessness and anxiety, with difficulty of swallowing, and oppression at the præcordia. In some cases the fatal termination is hastened by the occurrence of hæmorrhage, which is a very unfavourable symptom, and indicates great weakness of the system; the perspirations become cold, and more copious, the patient is weak, comatose or delirious, and the fatal termination occurs in some cases from the first or second day, to the sixth or seventh. The gangrene sometimes extends to the stomach, in other cases to the lungs.

Such a state of gangrene is more common and fatal than is generally supposed; many cases of membranous angina are certainly of the nature of this angina;* it is invariably the peculiar state of the system to which the treatment should be directed.

3. *Stomach and Intestines.*—Under this variety is included the rare form of mortification, improperly designated idiopathic, an example of which is related by M. Billard in his admirable work on the Mucous Membrane.†

Gangrene of this membrane is of more rare occurrence than the last; and is not so much produced by the severity of inflammation, as by the peculiar state of the constitution, and the exciting cause. It is indicated by the cessation of pain, and by great prostration of strength, and other symptoms of gangrene.

---

* Sphacelus vero faucium semper lethalis, Plenck nov. syst. Tumorum, pars prior, p. 54.

† De la memb. muqueuse gast. intest. p. 518.

On dissection the part is indicated by the light yellowish brown or black sloughs, possessing a peculiar smell and circumscribed by a swelling of the mucous membrane.   When the slough separates, the ulcer is left with a sharp irregular edge, and sometimes perforates the gut.   In other cases, several small spots become gangrenous.

Gangrene in the mucous membrane of the air passages, and urinovaginal passages, does not frequently occur.

Mortification in osseous tissue.

Necrosis, or the death of bone, is of rarer occurrence than might be expected from the low state of vitality of the tissue; it escapes in consequence of its defended position, and the vascularity of the membrane which surrounds and shields it from injuries.   From such peculiarities, exfoliation takes place more slowly than in softer parts of the body, so as often to require the interference of art to complete the separation; its occurrence is also much less dangerous, while the treatment is so simple, as not to require notice in these remarks on mortification.

Gangrene of Internal Organs most commonly occurs sympathetically; from the high degree of vitality which internal organs possess, and the care Nature has taken to defend them from the influence of the exciting causes of gangrene.   In these rare cases, therefore, in which gangrene occurs, it may be considered as almost invariably fatal, as it proves a great degree of depression in important and highly vital organs.

Brain.—In some cases of wounds penetrating the brain, portions of it have been found soft, dark coloured, and even black.   Dr. Abercrombie supposes that these may be produced in old people from ossification of the cerebral arteries.   Dr. Baillie met one case of this kind, in which a portion of the brain, at the inflamed part, was of a dark brown colour, and as soft as the most rotten pear.[*]

Lungs.—Laennec, by whom our pathological knowledge has been

* Morbid Anatomy, 5th edition, p. 452.

M

so much extended, first described gangrene of the lungs.* Since
then Cruveilhier, Andral, Bouillaud, Roche and Sanson, &c. have
enlarged our information regarding this disease; and from their ex-
perience, it appears that it does not follow severe inflammation of
the organ; but rather seems to be of the peculiar nature of symp-
tomatic gangrene, in other parts of the body.† The great prostra-
tion of strength, and anxiety, the fœtid breath, and the green and
brown sputa, having the peculiar fœtor of gangrene, are sufficiently
characteristic of the disease, which is always fatal.

TREATMENT.—The indications to be observed in the treatment of
symptomatic gangrene are nearly the same as those of the accidental
species. But in this form more attention should be directed to the
constitutional cause, by improving the health, changing the air to a
high and dry situation, by the exhibition of quinine, and prescribing
light nourishing food, and by paying attention to local symptoms, which
must regulate the applications. The prognosis must be more guard-
ed in proportion to the severity of the disease with which it may be
combined. M. Dupuytren employed bleeding with the best effects,
in cases where the pain was severe, the swelling considerable, the
face of a natural red colour, and the pulse full and hard. "Having
tried, says this able surgeon, the usual remedies in a case of gan-
grena senilis accompanied with protracted attacks of severe pain,
that had prevented the patient obtaining any natural sleep for months
before; from the full hard pulse, the florid and animated appear-
ance of the face, I bled the patient; and this course calmed the
pain, and she was able to sleep. From that time the progress of
the gangrene was stopped; and by continuing to take hints from the
juvantia the painful symptoms of the disease were arrested, the
gangrenous parts separated, and the person was cured."‡ Since
that time Dupuytren employed the same plan of treatment in se-
veral other cases with equal success.

When this form of gangrene occurs in old age, from the ossifica-

* Diction. des Sciences Med. tom. 17. p. 323.

† L'inflammation developpée de la partie gangrène paraît être effect plutôt
que la cause de la mortification, Laennec l'ans med. 71. p. 443, 2nde edit.

‡ Dict. de Médecine, art. GANGRENE, tom. 10. p. 65.

tion of arteries, much greater care is required than in the other species, in the use of the knife. In old age, the part stricken is strongly predisposed to the disease, by the state of ossification; and the constitution is in a great degree of weakness, and does not admit of being improved. In such instances, a useful test will be found in the strength of the effort which nature employs to separate the diseased part. Should this be considerable, the knife may be employed with a proportionately greater degree of confidence. Such cases are, however, rare, and in general palliative means can alone be had recourse to, in order to assist the efforts of nature to check the progress of the disease, and to separate the dead part.

ORDER III.

SPECIFIC INFLAMMATIONS.

In this numerous order, inflammation is often only a symptom of the disease, and in the treatment generally an unimportant one. In each of its forms the inflammation has specific characters, it attacks the skin in scarlatina, measles, and small pox, and in certain forms of erysipelas and ophthalmia, fungus hæmatodes and cancer; the glands in scrofula, plague, mumps, syphilis, &c.; the joints in rheumatism and gout, &c.

These specific diseases being sometimes caused by the introduction of a poison into the system, produce ·peculiar effects upon certain tissues of the body. In some cases this form of inflammatory disease is hereditary, when plethora, from free living and indolent habits, acts as its exciting cause. In other cases, indigestible and slightly nourishing food, and exposure to cold, damp, impure air, and unhealthy climates, act in the same way. The weak and infirm state of the body produced by intemperance, and previous attacks of disease, predispose the individual to the influence of such causes.

In other cases wounds of tissues in which there is little vital power, as in fasciæ, or tendinous expansions, certain poisons inserted by wounds, or taken into the system in any other manner,—as by being absorbed from foul sores, &c. produce the same effect. In some cases such local effects produce a degree of inflammation, and neigh-

bouring condensation, which prevents for some time the absorption
of the specific animal matter into the system. Thus cerebriform,
cancerous or circumscribed tumour of the lungs, liver, &c. sometimes
produce such a degree of inflammation and thickening around them,
that they extend to a considerable distance, and often ulcerate and
soften before the parts are sufficiently weakened, to admit of any of
the morbid matter being absorbed so as to infect the glands, which
are the parts most predisposed to such attacks.

Another remarkable peculiarity of many of the diseases of this
order of inflammations is, that a person can generally only be affected
once with such diseases, and the young are particularly susceptible
of their influence. The contagious diseases which may occur several
times in the same person, as typhus, plague, dysentery ; and likewise
those which attack a person but once, depend on the presence of some
specific morbid matter which is generally propagated from one to
another, and can thus be communicated to others who have not had
the disease before, in constant succession. Such contagion is more
virulent, and spreads further in the one form than the other.
Great heat or cold destroys the matter of contagion.

The skin is the tissue most frequently affected in this order of
inflammation. In each form the disease generally attacks particular
tissues : the absorbent vessels, and particularly the glands, are too
most susceptible of scrofula ; while the breasts, testicles, and con-
glomerate glands, are the usual seat of cancer, &c.

These predispositions in the parts affected seem to be produced by
peculiarity in the exciting cause, as well as in the tissue of the
parts. This order of inflammations has also specific qualities, in-
dicated by its products being in one case cancerous structure,
and in another modified pus, by which the disease may be pro-
pagated, as in small pox, &c. In other cases the inflammation
is accompanied by the secretion of new parts, which are of a peculiar
nature. In some cases after peritonitis, deposits of the phosphate
and carbonate of lime occur. In some diseases of joints, ivory
deposits take place ; and after repeated attacks of gout, a new
substance, the lithate of soda, is secreted.

The secretion from specific ulcerations has the property, when
inserted by inoculation into a healthy person, of generating the
same morbid secretion, and producing the peculiar class of symptoms

of the disease. This is called *immediate or simple contagion.* The effects are here produced through the influence of blood; but not, as was supposed to be the case with small pox, by conversion of the blood into the same nature, or the assimilation of the fluids of the system which were thrown out upon the surface of the body, by an effort of nature, to form the pustules of small pox. This was long the opinion of both the vulgar and learned; and was supported by the names of Sydenham, Mead, Van Swieten, Cullen, &c. &c.

The inoculation of small pox, cow-pox, hydrophobia, certain forms of ophthalmia, syphilis, itch, and gonorrhœa, are familiar examples of this kind of immediate contagion.

Specific mediate contagion or infection may be conveyed for a certain distance through the air, or attached to clothes and the like; being inspired it is absorbed by the mucous membrane of the bronchi, and produces the same disease, in another individual. This, however, does not appear immediately on exposure to the infection, but after its introduction into the system the morbid matter remains for a certain period latent, without showing its effects. This period varies from a few hours, as in the plague, to 6, 7, or even 10 or 12 days. During this period the poison gives no evidence of its presence, and when once introduced cannot be expelled, nor the subsequent symptoms prevented by any means hitherto known. The course of variola may be taken as an example of such a disease. The fever after the latent period comes on at a particular time, and not, like other fevers, in an insiduous gradual manner. The state of fever is distinct, and of various duration. It generally commences with pain in the back and loins, nausea, vomiting, disposition to drowsiness, and coma. Towards the end of the third day from its commencement the eruption makes its appearance, first upon the face and neck, and then upon the thorax, abdomen, and extremities. During the fourth day the varioloid eruption spreads over the body. In the fifth, small vesicles appear, depressed in the middle, containing a colourless fluid, and surrounded by an inflamed areola, while the eruptive fever declines. On the sixth day swelling of the throat appears, and extends to the face; and on the eighth day, the pustules are completely formed. About the eleventh day, the face, hands, and feet, begin to swell, and the secondary fever generally makes its appearance. The swelling of the hands and feet gradually

subsides, and about the seventeenth day the secondary fever disappears.

The peculiar class of disease that is produced by exposure to certain specific poisons, is contagious, principally affects the skin, does not usually attack a person more than once during his life time, and some individuals seem to be exempt from their influence altogether. The causes of these peculiarities are unknown, and until a better explanation can be given we may say that they depend on a disposition in the nervous system to be affected in a way to which it is not again susceptible. This order of inflammation seems to operate through the blood, or particular structures, and gives rise to fixed and peculiar, but occasionally to variable effects. These varieties seem to depend principally upon the nature of the exciting causes.

In plague the fever and external inflammation appear generally within a few hours after exposure to the contagion. The inflammation appears in spots, which rapidly run to gangrene, and buboes, or swellings of lymphatic glands rapidly form, but rarely suppurate. The reaction is often imperfect, or is hardly observed, and is accompanied with paleness, nausea, vomiting, weakness of the pulse, with tremors, and confusion of thought approaching to stupor.

The *treatment* in specific inflammation will vary with the cause producing it. The first indication being to remove the cause, and the second to defend the constitution from its effects, by means of tonics, astringents, antispasmodics, and stimulants; according to the individual circumstances of the case. In other cases cauteries or the knife are required to separate diseased parts.

In all cases, the inflammation being but one of the symptoms of this form of disease, it is of great practical importance to discover the nature of the inflammation at as early a period of the disease as possible. When a mistake is made, very distressing consequences may happen, as in the following case.—A gentleman of a stout form and indolent habit of body, who had been nearly thirty years in India, was seized with an inflammation of his eye. There was great intolerance of light, considerable redness, more especially round the corner, and a contracted pupil. It was considered as a case of iritis. The patient was bled in the sitting posture and fainted when 8 or 10 ounces of blood were removed from the arm. He again fainted in

the evening. Belladonna was applied round the eye, and produced full dilatation of the pupil. Purgatives were given, and small and repeated doses of mercury were continued so as to affect the system as quickly as possible; low diet was enjoined. It was 10 or 15 days before the system was affected. During that time leeches were repeatedly applied to the eye, with blisters, &c. The eye seemed to get much better; it remained for some ten days clear, and well. He then supposed that he had caught cold ; the eye for a time got worse, and then it improved, and the stomach became very irritable: he threw up much bile from time to time, had no appetite, and was much prostrated in strength. The alternate recurrence of affection of the eye and stomach continued. The second eye became affected, and in this way matters went on until he died some nine weeks after the first attack.

I only saw this patient in the latter part of his illness, when it was evident it was not an attack of acute iritis. The conjunctiva was inflamed, but the pupil was clear and distinct ; the great intolerance of light continued, but it diminished and increased suddenly, and passed from one eye to the other, and then to the stomach ; it was also treated with colchicum with advantage. Had it been simple iritis, the cause would have been more evident; the characteristic symptoms of the change of colour in the iris and the external areola would have been more prominent, and the pupil perhaps affected with greater deformity, and adhesion of the iris to the neighbouring parts. This view was confirmed by the examination of the body after death. There was very little blood in the body, very little development of the chest and muscles, but an unusual quantity of subcutaneous fat, and a very unusual development of the abdominal viscera, especially the intestines. The only morbid appearance was an irregular oval space at the left side of the great curvature of the stomach, which was completely denuded of its internal mucous membrane. Indeed the peritoneum seemed to be all that prevented the liquids in the stomach from passing into the abdomen. Around this denuded part the mucous membrane was somewhat thickish and pulpy, though elsewhere and in some spots there appeared a congeries of red spots. This was a case of a gouty inflammation of the eye and stomach.

It is consequently of much importance to employ early treat-

ment in this class of diseases, as in some cases the constitutional effect may be in a certain degree modified, and in all cases diminished in violence, by treatment. With this intention much benefit will be obtained from the local abstraction of blood when there is merely pain present, which will always diminish the violence, if it does not prevent the occurrence of the paroxysm. When the symptoms of inflammation are present, we must wait until they have begun to decline, when leeches may be applied with the best effects, and will remove rapidly the distressing symptoms. When the internal organs are affected, general as well as topical bleeding will be instituted with the same advantages. Blisters and calomel purgatives will also be of great advantage, and will prevent a second attack. Sarsaparilla, nitric acid, and preprations of mercury to affect the system slightly, will likewise be of use. Older writers suppose that the poison after being introduced into the system might be expelled by emetics, sweating, and blistering, in accordance with their fanciful opinions grounded on the humoral pathology.

Specific Gangrene.—In this species of gangrene are included such as are caused by the specific action of certain poisons, which act locally, and sympathetically affect the system ; or commence constitutionally, followed by local consequences, according as the contagion acts by inoculation, or through the medium of the constitution.

The causes of this form of gangrene are either the use of certain articles of food in an unsound state, or inoculation with animal secretions.

I. Gangrene is sometimes caused by using vegetable food of an unwholesome kind, such as a peculiar description of diseased rye, called Ergot, or cockspur rye, damaged wheat, &c.* When such food forms a principal article of diet, for persons living in unhealthy situations in bad seasons, gangrene sometimes appears epidemically. The affected portions of the extremities,—the toes or fingers,—become first cold, stiff, and insensible ; deep seated burning, or lancinating pains, which are increased by heat, succeed, and after several days are followed by a slight swelling of the part, which becomes cold, livid, and then black. In some cases there is greater swelling, accompanied with severe pain in the part affected,

* Philos. Transactions for 1762. Morgagni, loc. cit. Epist. 53, sect. 24.

redness, and phlyctenæ. The patient feels an unusual degree of lassitude, both of mind and body, his face becomes pale ; the excretions are unhealthy, the pulse small and feeble, and during the paroxysm of pain fever is present, followed in some cases by stupor and delirium. The sphacelated part is black, hard, dry, and withered, and when nature arrests its progress, a circle of inflammation forms on the living part, where it joins the dead ; a line appears between these, and the sphacelated part is thrown off, with much suffering to the patient. In other cases the knife is required to complete the removal of the dead portion, and in others, the gangrene advances towards the trunk, and the sufferer dies.

In this form of gangrene the danger depends on the weakness of constitution of the individual, and the activity of the exciting causes. There is no known means of stopping the progress of the disease ; which is treated by alleviating its symptoms, and by assisting nature in the separation of the sphacelated part.

II. Animal secretions sometimes produce gangrene.

1. After the constitutional effect of small-pox, in each pustule of the eruption, a slough is left, producing the pit in the skin.

2. Malignant Pustule. * This peculiar disease makes its appearance in certain parts of Europe in insalubrious marshy situations, and during wet seasons, in those classes who are much exposed to the weather, to want, poverty and uncleanliness, and who are employed as attendants on domestic animals during certain epizooties, particularly that of carbuncle. In these cases the respiration of the diseased animals, inoculation with their diseased secretions, as touching the bodies, eating the flesh of dead animals which had carbuncles, wounds made with the knife with which the flesh of the diseased animals had been cut up, or the bites of certain insects which had been in contact with such bodies, are all causes liable to produce malignant pustule. For the same reason the affection usually occurs in parts of the body exposed to the air, but has been occasionally found in other situations, the palms of the hands, the soles of the feet, and the scalp excepted.

The disease commences by an itching sensation, which becomes painful and burning ; and on examination is found to arise from a

---

* Pustule maligne, Milzbrand, &c.

small red spot, slightly elevated in the centre, and terminating in
one or more vesicles, which quickly become livid. These break and
discharge a dark coloured sanies, which is found to be situated on
a deep seated hard immoveable circumscribed insensible flat tumour
of a livid dusky colour, and the size of a lentil. This becomes black,
and is converted into a hard black slough, which is surrounded by a
reddish areola, followed by considerable swelling. This inflamma-
tion reaches to a distance from the extremities, the parts usually at-
tacked by the disease, when they appear swelled and shining, and the
neighbouring cellular tissue is blown out, and crepitates. The pulse is
small, quick and hard, the skin dry and hot, the tongue parched and
brown, with nausea and thirst, accompanied by diarrhœa or constipa-
tion, great anxiety, fainting, and colliquative sweats in the severe cases.
In some others the progress of the disease to the trunk is very rapid,
the pulse becomes quick, intermittent and weak, prostration of
strength and great anxiety follow; in many such fatal cases nature
does not make an effort to separate the dead from the living portion.
In others, the disease runs its fatal course in the short period of two
or three days, and the body decomposes with unusual rapidity. In
some particular examples nature retards the progress of the disease
by an inflammatory areola, ulceration separates the dead parts, and
the wound heals by suppuration and granulation.

This disease differs in the following particulars from anthrax.

(1.) In being produced by the local application of a specific poison.

(2.) From appearing in a small red point, like a flea-bite, gene-
rally in parts, exposed to the air, and not in those containing much
cellular tissue, as the nates, back, &c.

(3.) From appearing locally; followed by febrile symptoms,
whereas these precede the local appearance of anthrax.

(4.) From the malignant pustule being almost invariably single,
whereas several carbuncles often appear at one and the same time.

. As the malignant pustule is, in the primary stage, a local disease,
it can be destroyed by strong nitric acid; and constitutional reme-
dies are to be administered in order to improve and strengthen the
system.[*]

---

[*] See Eneaux and Chaussier's excellent " Methode de traiter les morsures des
animaux enragés, suivie d'un precis sur la pustule maligne," p. 161.

3. *Pestilential Bubo* is first confined to the gland; and the inflammation extends to the neighbouring parts, which slough, if the habit be bad, but if healthy they separate, and no unfavourable effects ensue. This forms an important prognostic indicating the strength of the system, and a cure in such cases may be expected. In proportion to the healthiness of the purulent discharge and its continuance, the danger of infection will be diminished; but, as Dr. Russell advises, all such pestilential ulcers should be considered infectious, until the expiration of two months from the first attack.

4. *Hospital Gangrene.*—A phagedenic ulceration having a very irregular and sensible surface, which discharges a dark yellowish matter, having a peculiar fœtid smell; extends quickly, and reduces the part to a dark pulpy slough; often attacks a number of individuals with sores, under similar circumstances; and is propagated by inoculation; it constitutes the disease known by the various names of hospital gangrene, gangrenous or sloughing phagedena, putrid or malignant ulcer, hospital sore, contagious gangrene, pouriture d'Hôpital, &c.

Such an ulceration is more liable to attack those who have been exposed to a combination of debilitating causes, such as exposure to cold damp air, unhealthy situations, where a number of individuals are crowded in want, depression, and misery, living on unwholesome poor vegetable food of difficult digestion, having been weakened by previous disease, or by the debilitating influence of mercury and the free use of spirituous liquors. Such a combination of causes is capable of producing this disease sporadically.

These causes act powerfully when combined with great mental depression; and formerly produced the disease epidemically in fortified towns, ships, &c. Such was the bad air, the want of comfort, and the absence of every thing that could tend to ameliorate the diseases in the Hôtel-Dieu of Paris, that an old French author says, " a young surgeon bred in the Hôtel-Dieu may learn the various forms of operations, and the method of dressing sores; but the way of curing wounds he cannot acquire. Every patient he takes in hand (do what he will) must fall a victim to gangrene."

The attention which in modern times is paid to the comforts of patients, the open situations chosen, and the care observed in having good ventilation, in public establishments; added to the

more intimate knowledge happily now possessed of the disease,
explains the reason why it is so rarely seen in its aggravated forms;
patients are now placed under such favourable circumstances, com-
pared with those described by older authors, that this disease is scarce-
ly seen in its worst forms. These different accounts led some into er-
ror, and may be considered as the cause of the variety of names which
have been given to the same ulceration, at different times and
in different languages.

The misery of many amongst the lower classes in this country,
and in large manufacturing and trading towns in Europe, renders
them liable to this disease ; and explains the reason why cases of
hospital gangrene are to be seen in the jails of Bengal as well as in
the Parisian and London hospitals; in these establishments it is
prevented from becoming epidemic, by attention to ventilation,
and by the care with which the patient's comforts are supplied.

The following remarks are the result of an extensive and careful
examination of cases of the disease as they occurred among natives
both of India and of Europe. In these different situations and
climates, the peculiar characters of the disease were found to be
the same.

During the unhealthy season of the year, between the termination
of the rains and the commencement of the cold season, the prisoners
employed in Bengal on public works, who exist on poor indigestible
food, and are exposed to the influence of unhealthy changeable and
damp air, are often attacked with hospital gangrene.

The person first complains of a painful and irritable sore, caused
by the friction of his irons; he is observed to lose his usual appetite
and spirits, his face becomes peculiarly anxious, he feels feverish
towards night, and is distressed with nausea and vomiting; but in
other cases the constitution is very little affected, even where the
local disease is violent.

The part affected is first painfully itching, then becomes burning ;
the sore enlarges, and dirty ash-coloured sloughs form in one or
more spots, which quickly enlarge, and extend over the whole ul-
cerative surface. This ulcer is of an oval form, and is covered
with thick adhesive matter, giving the part a shining appearance,
often mixed with red spots ; it secretes a peculiarly fœtid discharge.
The borders of these sores appear natural; being neither elevated,

hard, nor red, but dark and irregular, and often extend rapidly, in-
volving large portions of skin, and cellular tissue, which in some
cases have large fibrous sloughs. In other cases the progress is
slower, and the surrounding inflammation greater. In some pa-
tients one part of the sore may be observed taking on a healthy ap-
pearance while the disease is advancing in the other direction, where
it has the black characteristic appearance. I have seen these un-
healthy sores situated near others which were more promising, without
affecting them ; but they immediately took on the peculiar character
of the complaint, when some of the diseased secretion was applied
to them ; a sufficiently strong proof of the local nature of the disease,
and of its being propagated by inoculation.

The constitutional symptoms which follow this disease in India
are characterized by the same feverishness and irritability, followed
by prostration of strength, cold perspirations, quickness and
weakness of the pulse, and the white and loaded tongue, thirst,
loathing of food, and irregularity of the bowels, which mark the
disease in Europe. In the damp and unhealthy coast of Arracan, ,
&c. the disease appears more frequently and is more fatal in its
consequences than in Bengal.*

In other cases, the disease appears in individuals already debili-
tated by dysentery, which it aggravates. The patient loses flesh
rapidly, by the continual watery evacuations; sometimes the ex-
tremities, especially the feet, become œdematous, and on the
swelled parts an itchy painful vesicle appears, which terminates in
a sore, and rapidly enlarges. Its margins are round, of the natural
or somewhat reddish colour, with a slough on the ulcer. This
extends along the cellular substance, and from that to the skin. In
this way gangrene advances unless the patient is previously destroyed.

The sporadic cases of hospital gangrene found in the London
hospitals occur in those females who expose themselves without
proper clothing to the inclemency of the weather during the night,
and generally indulge in large quantities of spirituous liquors. The
body in this state is exposed to the influence of morbid poisons,
generally aggravated by improper remedies, by the state of the

---

* Medical and Physical Society's Transactions, vol. 3. p. 267. See also Dr.
Adam's excellent description of the disease in the same volume.

system, and by the depressing passions. The disease is generally allowed to go on, and as long as the unfortunate female is able to continue her dissipated course, she does not seek assistance.

A very large proportion of such cases occurs in young females, who, at the time of admission, or a short time previous to it, had been affected with gonorrhœa, or syphilis. These diseases seem merely to act as local irritants in an unhealthy system, as sores, wounds, &c. take on peculiar appearances, under similar circumstances; and the tendency is always greater in proportion to the debility of the system, and the vital weakness of parts.

In such females, when the disease commences without the presence of an abraded surface, a painful itching first attracts attention to the part, where a vesicle is found, situated on a slightly inflamed base; in general on the mons veneris. This soon breaks, and a sore forms, having a stinging and shooting pain, which changes to a gnawing, burning, or shooting pain, or is followed by one of a lancinating kind. The gnawing pain occurs in paroxysms, and is peculiarly severe at night. In some cases the pain is so great as to prevent the patient from obtaining any sleep, which is but partial during the day, a time when the symptoms are somewhat mitigated. In general, towards the latter stage of the complaint, when the part affected has much cellular tissue in its composition, the pain is much reduced in violence, excepting when the part is put on the stretch, or in motion. In other, and more frequent cases, the pain continues increasing as the destructive process advances, and renders the sufferings most acute and distressing, from the low irritable and languid state of the patient.

When the disease attacks a wound, a peculiarly unhealthy pallid change takes place suddenly, with a cessation of discharge sometimes over a considerable surface. In other cases it occurs in the form of a vesicle, at the edge of the sore, accompanied by the peculiar shining appearance, and pricking burning pain, occurring in paroxysms, &c. The ulcerations, as in those from syphilis, are of a round or ovoid form, often of considerable depth, especially when there is much cellular substance at its inferior part, where matter lodges; its edges are hard and slightly irregular, with little swelling or redness. The surface of the sore is very deep, has an irregular yellowish brown colour, mixed with bloody points; or it has a thick

pulpy covering, of a dark colour, which in some cases extends rapidly, forming large insensible sloughs, in other cases more slowly, with less slough. In the first case, the disease advances, enveloping the cellular tissue, muscles, nerves, and vessels in the same destruction, from which a thick mucilaginous looking matter issues with portions of the dead cellular tissue. The discharge is thick, tenacious, and of a yellowish brown colour, with a fœtid smell, of a peculiar and characteristic nature; when the slough is not thick, pale, or red, spots or streaks of blood may be seen, frequently discharging a considerable quantity of this fluid; and in some cases the hemorrhage has been so great, as to prove fatal. The liability to these losses of blood will depend on the rapidity of the destruction, and the absence of local inflammation, as has been already explained. Owing to this circumstance, hemorrhage occurs oftener in the weak, and in the last stage of the disease.

Hospital gangrene is peculiarly liable to relapse, unless great care be observed in avoiding the exciting causes for a considerable period after the cure of the disease.

In the first stage the patient feels in health, has no fever, and follows his usual avocations, until the ulcer attracting attention obliges him to employ a poultice. It is then small and of a round figure, with its centre extending to some depth, its surface of a dirty brown colour, and its margin surrounded by a reddish areola.

The constitutional effects which follow the local sore soon become very severe. The pulse, which in the first stage was slow and natural, becomes small, weak, and frequent. The patient feels much debilitated, loses flesh rapidly, shows great general irritability, has free perspirations, and his countenance becomes sallow, and has a characteristic appearance of great anxiety. He is then extremely fearful of present pain, and dreads the result of the disease. This irritability becomes peculiarly evident when his sore is touched, when it seems to produce the most acute suffering. The skin is hot and dry, and acquires at length a cold and clammy feel. The patient has no appetite, but rather loathes his food, his tongue is moist, but becomes in many cases of a bright red colour, or white, dry, and brown; he complains of thirst; his bowels are sometimes costive, and at other times diarrhœa aggravates the disease. In

the later stages, the patient is much reduced in strength by copious sweats, feels very hot, and is continually complaining of thirst.

The redness which is found in this disease around ulcers, has not the florid colour of healthy inflammation ; but has a dark erysipe-latous appearance, and is not painful, even on considerable pres-sure being made upon it. It is on account of this unhealthy nature of the inflammation that we do not find the vessels filled up by consolidated blood, before they ulcerate; when violent hemorrhage follows. This seems to be particularly the case when the disease has advanced rapidly, although in general this effusion of blood diminishes somewhat the disease, but its effects are not so consider-able as might be expected, from such an evacuation.

Nature in such cases employs various means in order to destroy particular portions ; sometimes the process is slow, and the parts are absorbed, accompanied with a purulent discharge ; when the disease is of a severer nature, a rapid ulceration destroys the part, previous to the appearance of any inflammation, and streaks of blood are exhi-bited on the surface, in consequence of small vessels being opened in the process of the ulcerative separation.

These sloughing phagedenic ulcers destroy principally the skin and cellular tissue ; but no tissue seems to be exempt from their influence. The muscles, the tendons, &c. are often destroyed, while the change of colour varies according to circumstances,—the constitution, the vitality of the part, its texture, &c. The more the part is vital, or is supplied with vessels and nerves, the less liable is it in general to the rapid destruction caused by these ulcers ; when destruction occurs, the change which takes place in the tissue is great-er ; tendinous, and other denser tissues, from being endowed with little vitality, resist destruction less, and the slough is generally large, and less changed, than in other tissues.

The vessels, and particularly the nerves, impede the destructive progress of the ulcer, and may often be seen apparently unchanged, while the surrounding less vital parts are destroyed, and reduced to the state of pulp. In these cases the vessels and nerves, when so exposed, have often a covering of granulations, and their proper tissues are thickened, and are thus defended from the encroachment of the disease.

The destruction of parts in many cases of hospital gangrene is

most extensive, and is always in the inverse ratio of the vitality of the tissue; on this account, the cellular tissue, from its exposed situation and low vitality, is extensively destroyed, and then the skin is involved and the disease extends between the muscles, dissecting them from each other, and exposing the large vessels, which may be seen passing over the ulceration, with their coats thickened by a covering of small granulations, which defend them from the destructive influence of the disease. The smaller vessels are not so protected; and from their intimate connection with the surrounding tissues are, in ordinary cases, ulcerated, producing a bloody discharge from the ulcer. In cases of greater weakness the large vessels are not defended by granulations and adhesive inflammation, and in consequence of their ulceration, the unfortunate individual speedily dies from loss of blood.

This disease is of a specific local nature, and is accompanied with a peculiar general state of the system. The disease is either produced sporadically, from a combination of peculiar constitutional and local causes, or by inoculation. The digestion and circulation are as usual; and the presence of this dreadful disease does not appear to produce bad effects on ulcers, which I have seen healing in one part while the hospital gangrene was producing the most dreadful ravages in another. In cases where leeches are applied to the neighbourhood of the sore, in order to reduce the local inflammation, their bites often heal as when in health. In such cases the patients lived in large well ventilated hospitals, and enjoyed every comfort.

It would consequently appear that this is a specific local disease, produced by an impaired state of health, combined with the operation of other exciting causes; such as impure air, &c. which affect the constitution sooner or later. The constitutional effects become more powerful, as the disease advances; the febrile state, which occurs towards night, and the pain felt in the sore, increase the sickly appearance of the patient, which becomes haggard; there is great irritability of the whole system; the pulse is small, frequent, and fluttering; the patient becomes low, has copious perspirations; and dies from exhausted excitability.

The disease is cured by the complete destruction of the surface

N

of the local sore, whilst constitutional treatment is of little or
no avail, except in so far as it calms painful and morbid symptoms.
In some such cases amputation should be performed; by which
operation the local cause will be removed, and the cure of the con-
stitutional effects will quickly follow.

This disease is contagious, but not infectious, when proper ven-
tilation is observed, so that in hospitals, where ventilation is perfect,
the patients affected with it are not required to be placed in sepa-
rate wards, but may be allowed to remain surrounded by others,
without any fear of the disease being communicated. Mr. Bell re-
lates, that "In Yarmouth the English seamen who were wounded
on the 11th October were divided from three hundred wounded men
of the Dutch, only by a wall; the great wards were on opposite
sides of the partition, under one roof; on the one side of that par-
tition we operated on men and boys, opened sinuses, or searched
for balls or pieces of shot, as freely as in the most healthy hospital,
or in sick quarters; not a sore was to be seen there except such as
were the inevitable consequence of gunshot wounds with carious
bones, &c. But on the other side of the partition wall were such sores
as are seldom to be seen, prohibiting all operations even the most
trivial." In these cases, however, it must be recollected that all di-
rect communication was forbidden, no sponges were allowed, but
every thing employed in cleaning the sores was destroyed or tho-
roughly cleansed, previous to its being used a second time.

From the circumstance of some wards of hospitals being circum-
scribed and ill ventilated, in such cases it will be necessary to remove
the patients to other wards, better circumstanced. It is from the
continuance of a number of patients in wards, under like circum-
stances, where the air is bad, and little attention is paid to their se-
paration, that the hospital sore is apt to attack a number of indi-
viduals, who, otherwise situated, would have been exempt: it is
thus that many have been improperly led to suppose that the
disease is contagious.

As the disease is local, and the constitutional irritation slight, in
the first and second stages, local means are to be employed, such as
the abstraction of blood, &c. Should the local redness be consider-
able, these topical remedies will be found the most powerful means

of diminishing the constitutional irritation. If simple dressings are had recourse to, they alone will not stop the disease, and all wet dressings, such as fomentations and poultices, only afford temporary relief. The most favourable plan of treatment consists in the application of escharotics in order to destroy the diseased surface; after which narcotics may be administered not only to diminish the pain of the application, but also the constitutional irritation. For this purpose the concentrated nitric acid is applied,* after as much of the slough and secretion has been removed as may be found convenient. The acid is applied by first defending the borders of the ulceration with hog's lard, or oil, and carrying very steadily over every point of the ulceration a dossil of lint wet with the concentrated acid, so as to reduce the whole to a dry slough. This application in general produces severe pain, but which soon diminishes: in the space of one or two hours the patient is easy, and generally for the first time, often for a long period, obtains a good night's rest. A piece of dry lint is placed over the ulceration, and a dose of opium is given to the patient, and this is repeated at bed-time.

Sometimes the acid does not require to be applied more than once, but, in other cases, it must be used three or four times before the disease is completely removed, and the sore takes on a healthy appearance. The slough in general comes away the second day after the application. In all cases the desired effect will be produced by the proper application of the acid, and it therefore precludes the necessity of using other escharotics, as the solution of the crystallized nitrate of mercury in nitric acid, the liquor arsenicalis, &c.

When the ulceration is very large, and from the nature of the parts there exists no possibility of applying the concentrated acid over all the surface, we may employ fumigation with cinnabar, often with the best effects.

In these cases the chloride of lime may be employed for removing the fœtor, and it would seem also to stop the progress of the disease, but it cannot be relied upon as a means for curing the disease. Charcoal poultices will sometimes also be found useful, improving

* First recommended by Mr. Welbank at St. Bartholomew's Hospital, London; see the interesting paper on this subject in Med. Chirur. Trans. vol. 11.

the appearance of the sore, and particularly correcting the fœtor of the discharge. In other cases yeast poultices will be found a good application to the primary or more simple kinds of sores.

The hemorrhage which is liable to take place is often of great advantage ; and would seem to indicate that blood-letting may sometimes be useful. We must not suppose in this, as well as in other diseases, that an apparent prostration of strength is always a proof of actual weakness ; for that is often produced by the violence of the disease, and is most effectually removed by lessening the cause of it. When the penis is affected with a sore which takes on the phagedenic sloughing character, great swelling generally ensues. This appearance might seem to indicate the necessity of bleeding; which when performed often gives great relief ; but on it alone little reliance should be placed.

As this disease is local, the most powerful means of combating its effects on the constitution are topical remedies ; but advantage may be reaped from employing constitutional means also. The simplest most easily digested food, accompanied by an acidulated beverage, ought to be preferred ; whilst narcotics will be found of consequence by removing restlessness and irritability, and promoting quiet, and sleep. This is particularly evident after the constitutional symptoms have appeared.

But such remedies will often be tedious, and in a few cases of little use, unless the person removes to a purer, warm, high, and dry atmosphere, and pays particular attention to his general health. The following is a description of the course of a fatal case of this disease.

Case.—Sept. 14*th*.—Eliza Shephard, æt. 19, was in a delicate state of health when admitted into hospital ; she had gonorrhœa and sores, to cure which the mercurial ointment was rubbed in every night. In the course of a week the sores healed up, and the discharge ceased, but the mouth was not affected. When admitted, she had a blister between the small toe and the next, which was very itchy and stinging ; it increased rapidly, and became sloughing, for which she was fumigated with cinnabar, and a carrot poultice applied. She took opium at night, and subsequently two grains of calomel, and half a grain of opium, twice a day. The small toe was soon consumed, and the disease attacked the next one in the same

way, and in a few days extended to and destroyed all the remaining toes. Large doses of opium were obliged to be given to quiet the powerful shooting and gnawing pain, which increased towards night, preceded by shivering, sickness, &c.

A large ulcer now covered the whole depth of the foot, over which a thick yellowish slough was situated, in the midst of which the black metatarsal bones were exposed, where they are united to the tarsal bones. This ulcer was swollen, and surrounded by a red areola, and extremely irritable, so that the lint was removed from the sore with much difficulty, and produced great distress. She was soon reduced to the lowest state of emaciation, with a face peculiarly anxious, and indicative of great distress; she continued moaning in consequence of the severe burning, gnawing pain which shot up the leg, increasing towards night, causing her to complain loudly. To allay this state required large stupifying doses of laudanum, from which alone she obtained relief, and a little unrefreshing sleep. The pulse was very small, irregular, and giving 144 pulsations; no appetite, great thirst, tongue clean; no catamenia for 7 months before.

It was proposed to remove the leg, but she obstinately refused to allow of the operation being performed. She had the unguent. æruginis applied to the sore three times, and although it looked a little better for a time, it subsequently extended very considerably; the extremities of the metatarsal bones became exposed, and the ulcer spread upwards of an inch, where it was more superficial. Beyond the ulcer, the skin was red and swollen. She moaned continually, and whenever a stimulus of one kind or other was not applied; which seemed to relieve by destroying part of the surface. Her cries became of the most distressing nature, keeping the whole ward awake during the night. The opium deadened the pain for about two hours; at the expiration of which short period she again commenced moaning as before its exhibition; towards morning and during the day she obtained a little sleep, which was by no means refreshing; pulse bounding, soft, and 140.

For three or four days she continued to decline rapidly, and was reduced to the last stage of emaciation; her tongue and mouth were covered with aphthæ, great pain was felt in the abdomen, with diarrhœa; the low pulse, and anxious countenance, were peculiarly striking. For some days the sore increased rapidly, especially along the anterior part of the leg: in these places it commenced with small round vesications with a shining surface containing a dark fœtid sanies. In about 12 or 18 hours they seemed to

go through their course, leaving a foul deep sore, with a yellowish ash-co-
loured slough, a sanious discharge, and pale unelevated edges without any
inflammation.   Three of these appeared in succession on the anterior part
of the leg, and after bursting the sore soon extended and joined the other.
Amputation was again proposed, and acceded to by the patient, but when
brought to the operating room, she was so low, as to render the postpone-
ment of it necessary.

13th.—Dozed a good deal during the day ; a considerable quantity of
brandy was administered as she continued very low; pain in the limb di-
minished, owing to her state of weakness.   The diarrhœa and sore increas-
ed rapidly, the   whole surface of the sore covered with a dark foul
slough.   There appeared no redness, but a dark dirty lividness round
the ulcer ; vesication preceded the ulceration, which was of a dark colour.
She languished for several days, and gradually sunk.

Dissection.—On dividing the skin over the sore, we found that the
gangrenous appearance extended about four inches beyond the part which
appeared externally diseased.   The vessels were healthy, much lower
down than the muscles; and as the disease had extended very slowly
at the foot, no change was found in the vessels, to the spot where the trunk
received a number of branches.   The glands in the diseased side were
swelled ; but the lymphatics seemed healthy.

In the above case a solution of the protonitrate of mercury, red
precipitate ointment, solution of opium, and arsenic ; Lin. ærugi-
nis, &c. to the sore ; with large doses of opium, bark, brandy, and
eggs, wine, &c. were employed, and alternated as they seemed to be
required ; but the diseased surface was unfortunately not destroy-
ed by the strong acid.

5. *Leprosy.*—The history of this disease is so interesting, its
symptoms and course so peculiar, and the results of it so fatal, that
it deserves the peculiar consideration of the profession.   I shall
only notice, in this place, its producing gangrene at the extremities.
These parts are affected with torpor amounting almost to insensi-
bility ; and without any apparent exciting cause phlyctenæ appear
on them, under which the skin is in a state of gangrene, which often
involves some of the joints of the limb.   The slough falls off, leav-
ing a wound, which generally takes on a healthy granulating appear-
ance, and quickly cicatrizes.   During this healing process, the parts

continue in the same state of torpor, and after a longer or some-
times a shorter interval, other parts become affected in a similar
manner, and members are successively destroyed, leaving the unfor-
tunate individual a deformed cripple, until the disease advances so
far as to involve also vital organs in its destructive process; or the
debilitated constitution of the patient sinks under the frequent re-
currence of gangrene.

BOOK II.

INFLUENCE OF LOCAL INFLAMMATION, AND OTHER DERANGEMENTS OF
THE CIRCULATION, UPON THE FUNCTIONS OF ORGANS, AND UPON THE
FUNCTIONS OF SECRETION AND ABSORPTION, PRODUCING THE CLASS
OF DROPSICAL DISEASES.

These remarks ought to embrace the consideration of the effects
of inflammation upon the functions of nutrition, relation, and ge-
neration, but, as these effects will be better investigated when con-
sidering the inflammation of the different classes of organs, I shall
confine my remarks in this chapter to the peculiar effects of inflam-
mation upon the functions of the vascular system, as it affects secre-
tion and absorption.

As the most frequent, evident, and important form of these ef-
fects are seen in the cellular structure and serous sacs, I shall con-
sider the changes produced on the functions of secretion in these tis-
sues when inflamed. The capacity of the cellular tissue varies much
according to the part, the age, and state of the body. When filled
with serum or fat it enlarges and takes different forms; but the serous
cellular tissue appears to differ from the fatty, as in the first variety
the cells communicate with each other, and in the other they are
separate and distinct.

In the state of health the body is nourished by the blood, from which
a transparent serum is secreted into the cellular tissue and serous
sacs, by which they are moistened and rendered flexible. This secre-

tion differs in quantity, according to the exercise of the part, and the absence of fat, and consists of serum; as it coagulates into flakes on alcohol being injected into the cellular tissue; probably it is the same kind of fluid as the contents of lymphatics, with the addition of some animal matter. In health this secretion is absorbed, so that no accumulation takes place beyond what is required for the purposes of the part. In diseases this balance in the transudation and absorption is generally destroyed; so that one or both of these functions may be diminished or increased in quantity. When the secretion of serum is diminished in the part, it becomes dry and parched, and the functions of the organs are impeded; as in severe local inflammations. But an accumulation of secretion in a part is a common consequence of disease; and may occur from an increased secretion, or diminished absorption. It is supposed that serum in general accumulates by diminished absorption; but a more common species of dropsy is produced by increased secretion, when the absorption which is not under the direct influence of the heart's action remains unaltered, or is even increased by increase of the vitality of the part; so that fat, muscles, and even bone, are absorbed, mercury taken up, and ecchymoses removed, when the person is labouring under dropsy. The consequence of such a state is an accumulation of serum into the general cellular tissue, or serous sacs, which gravitates to the most depending parts. This increased secretion being only a symptom of a certain morbid condition of the part, and in a therapeutical point of view, but an unimportant one, it is of great consequence to mark the exciting cause, and by detecting the true nature of the disease, arrive at the best means of avoiding its causes, and removing the consequences, after they have appeared.

The following remarks on dropsy will be classed under the heads of chronic causes, and acute causes. By this arrangement the different causes of dropsy will be enumerated from the more simple to the more complicated.

CHAPTER I.

OF CHRONIC DROPSIES.

The chronic or indirect causes of dropsy embrace the effects of cold, of the consolidation of blood, and dibility.

Mechanical obstructions to the circulation give rise to different symptoms, according to the part of the vessel and the nature of the tissue, or organ, particularly affected. From the veins being less under the influence of the heart, the obstructions most generally occur in them, the first effect of which is an engorgement of the veins which poured their blood into the obstructed vessel, particularly when the part is vascular, and the veins have little support from the neighbouring parts, and local predisposition to enlarge, such as occurs in those of the liver, heart, and brain. In such cases the face, and particularly the lips, become livid; the vessels of the mucous membrane of the intestines, or bronchi, become distended, and not unfrequently bloody secretions occur, developing the diseases called melæna, hæmoptysis, &c.; in other cases the distended vessels are ruptured.

When these congestions of blood take place in a more chronic form, the distention of the capillary vessels prevents absorption, and a collection of serum is the consequence either into the cellular tissue or serous sac, according to the functions of the part particularly affected, which diminishes the vital powers of the capillaries. Such an over-distention of vessels allows the serous portion of the blood to transude through the parieties of the capillary ramifications, while the weakness diminishes absorption.

By observing the progress of dropsy we can often distinguish the trunk of the vessel particularly affected; and are thus led to the detection of the cause, and consequently the best means of curing it, and preventing its recurrence. When the vena cava ascendens is obstructed, the inferior extremities and scrotum are affected; when the vena portæ the peritoneal sac; when the heart, general dropsy, or dropsy of particular parts, according to the element of this organ which is affected.

By the arrangement above indicated we more readily arrive at the

true nature and best means of preventing and curing dropsy, which
has led me to reduce the following observations on this head to

1*st*, The influence of cold in producing congestions in veins from
their extremities to their centre; and *2ndly*, Causes which produce
a mechanical obstruction to the return of the blood by the veins.

SECTION I.

1. *Influence of cold in producing a mechanical obstruction in the circulation followed by Dropsy.*

For better understanding the effects of cold on the body, it is
necessary to recollect that the temperature of inorganic matter has
always a tendency to approach that of the media among which it is
placed : while that of organic bodies observes certain laws independ-
ent of the substances which surround them. This property of
organic bodies is called *animal temperature.*

The power of generating animal heat follows the same laws, but
varies in degree, in different classes of the animal creation, in differ-
ent ages, and in parts of the body. I shall now offer a few remarks
on each of these peculiarities.

In the simplest form of animal structure, as the class of zoophytes,
little animal heat is generated; reptiles and fishes have a degree
or two of greater heat than that of the media in which they
live : in birds this temperature is much higher, in consequence of
the more perfect manner in which respiration and circulation are
performed. In fever and other sthenic diseases the temperature is not
always increased in proportion to the rapidity of the circulation, as
the respiration may not be proportionally increased. Sudden
and great changes in animal heat seem to show that different
kinds of fever are caused by derangements in some of these parts,
so that the heat is increased wherever an action is carried on for
which heat is necessary. The difference of the degree of generating
animal heat in peculiar species of animals is proved by the different
resistance they afford to being affected with cold or heat; which
(after making allowance for the difference of animal coverings) is in
the inverse ratio of the power of producing animal heat.

The animal heat is one and a half degrees lower when the indi-
vidual is asleep than when awake; after fasting, than after the good

digestion of nourishing food, &c. The young of animals, like those of man, generate less animal heat than when they reach their full growth. In like manner when a young animal of the class mammalia is exposed to severe cold, a suspension of life is soon produced, and this apparent death is soon followed by the real. Should external heat be cautiously applied when the animal is on the point of expiring, its life may be saved. When the cold is less severe the effect is more gradual ; but it is always greater, like the power of producing animal heat, and in the inverse ratio of the age. Thus in an infant of 7 months, the temperature was found to be 89.6 (Fahr.); the average of ten infants from a few hours old to two days, was found to be from 93.2 to 95.9 ; that of adults 96.8; and that of an old man from 93.2 to 95.[*] Hence the young and old suffer more from exposure to cold than the adult.

In the most perfect state of the body it admits of less changes in its degree of temperature, and it has a greater power of resisting heat than cold, and hence change under the average standard is more common than that above it; and for the same reason the extreme parts admit of a greater latitude in their degree of heat than the more internal. The effect of cold upon the sensible skin of the infant is great, and from the diminished powers of producing animal heat at that age, the effect is permanent, especially when joined to other debilitating causes ; hence the infant is more subject to the bad effects of exposure to cold in the inverse ratio of the age ; premature infants, twins, &c. also suffer much from exposure to cold.

Thus animal heat in a particular part " is a sign of strength and power of constitution, although it may arise from the increased action of weak constitutions or parts." (Hunter, vol. 2. p. 25.)

The animal heat is not confined to one part, but is developed in an unequal degree in all parts of the body ; being greater in the internal parts than at the extremities, where the functions of the circulation are less energetic, and the exposed surface is greater; hence the first appearance of œdema usually takes place at the extreme parts of the body.

From these facts we may conclude that the power which a part possesses of resisting cold is in proportion to the heat it evolves,

* Edwards, de l'influence des agens physiques, p. 235.

and the surface that is exposed. Thus animal heat is greatest in the trunk, and least at the extremities, and in like manner the effects of cold are greater when applied to the latter than the former parts.

The importance of guarding against cold in the young of animals becomes sufficiently obvious when we observe the care with which nature guards against its influence in the early stage of existence in cold climates. We then find by an instinct in the parents that a warm habitation is provided, and the animal is brought forth in a temperate season of the year, is covered with a warm covering, assisted by numbers and the care of the parents. Such are the precautions employed in their early stage of existence ; but, as the young advance in age and strength, these means of defence against cold are gradually withdrawn, by the change of their covering, and the less vigilance of the parents, until the offspring are fitted to support separate existence.

In the first stage of man's existence he is in the most helpless state, and his organization is eminently sensible to the pernicious effects of the elements which surround him, had not nature provided against it by his proud prerogative, reason ; by which his parents have the means of procuring and preparing for his defence, and become solicitous to guard against the influence of external agents. Such principles of conduct are often neglected or even opposed by fashion and custom, and most dangerous means adopted in order to strengthen the constitution to bear the vicissitudes of the weather. For this purpose authors have recommended the exposure of infants to cold, to fatigue, and to hardship, from their ignorance of the laws which regulate the development of animal heat in different ages ; observing the good effects of cold upon the strong body of the adult, in invigorating the system, they absurdly supposed that it would likewise strengthen that of the infant.*

* " Un grand nombre de nations du Nord," observes Virey, " plongaient leurs enfants naissants dans l'eau froide, ou même les etendaient jadis sur la neige ; c'etait la coutume des Ecossais, des Irlandais, des anciens Helvétiens, et Germains, des premiers habitans de l'Italie, dont une poète a dit :—
     Durum e stirpe genus, natos ad flumina primum
     Deferimus, sævoque gelu duramus et undis.
Les Morlaques, les Islandais, les Sibériens, et plusieurs autres, pratiquent en-

From the preceding remarks we shall be prepared to expect that when infants are exposed to a considerable degree of cold soon after birth, morbid effects will be produced which will commence at the extreme parts of the body where the exposed surface is largest, and the power of resisting cold is the least. I shall now consider some of these effects which I had an opportunity of seeing while attending the Foundling Hospital at Paris during the winter of 1825. This institution owes its origin to a benevolent individual, and its sphere of operations has been augmented, at different times, by legacies left to it. It was at first intended for the reception of infants born at Paris, and the neighbouring provinces only; but since then, all children presented at the door under two years of age, are admitted. The great proportion of infants, however, are brought from the General Lying-in Hospital of that city, which is situated at some distance from the Foundling. The practice is to remove the infant from its mother almost immediately after its birth, and bring it to the Foundling Hospital, formerly without taking proper precautions for defending it from cold. Auventy has described the state in which infants are brought to the Hospital as follows: " Many infants are brought covered with a few rags, quite insufficient to defend them from cold; while others are almost naked, and brought in baskets containing straw, or shavings of wood. We have several times witnessed that painful and afflicting sight, so proper to excite in every sensible person the movements of a just indignation against such unnatural conduct."*

The highly organized state of the skin of these infants renders the effects marked, and from the imperfect manner in which their lungs admit air, and the weak power of generating animal heat, these effects are permanent. But these effects, like the power of producing caloric, will be different in different cases. Where the surface is extensive, and the vitality low, as in the extreme parts of the body,

core cet usage aujourdhui, ce qui habitue de bonne heure l'homme à la froidure, et lui donne une santé plus robuste; *neanmoins il faut redoubter l'endurcissement du tissu cellulaire, qui rend molette la peau de ces enfans, et les fait périr.* Hist. Naturelle, &c. tom. 1. p. 89. See also Lock's Thoughts concerning Education, section on Warmth, p. 10. J. J. Rousseau's Emile, tom. 1. liv. 1.

* Memoires de la Societé Royale de Médecine pour 1787 et 1788.

the effects will be necessarily greater than in parts in opposite circumstances.

When cold is applied to such a part as the skin, it becomes pale, from the absence of blood in the capillary vessels; but as the larger arteries are more particularly under the influence of the heart's action, while the more superficial and less vital vessels are more powerfully affected, the sedative effects increasing, extend to the larger branches of arteries, when the skin becomes still paler and the circulation in it ceases. If the cold is continued, the action of the heart itself finally becomes slower and weaker than natural.

As the cold does not affect the two systems of vessels equally, from their respective situations and the influence of the heart, the veins cannot push forwards the blood sent by the arteries, and by its accumulation in these vessels the part becomes of a blue colour, as is so often seen in the lips, nose, &c.

When the secreting surfaces are affected with cold, as the cellular and serous tissue, the secreting vessels, by the influence which the heart has upon them, and their higher organization, secrete much longer than the absorbents act, which is followed by a swelling in the part from the accumulated secretion. This produces dropsy, with the formation of a peculiar principle which M. Chevreul found coagulated by cold.* In this manner we explain the cold, hard, distended limbs of infants, the great debility, particularly in the venous circulation, with the consequent engorgement of these vessels in the surface; but as the disease advances, it extends to the internal organs. This constitutes the peculiar and very fatal disease called concrete œdema of children.

The *Concrete Œdema* † commences most commonly within the first week after birth, in the form of a swelling of the extreme parts of the body; more particularly where the cellular tissue is most

---

* See Recherches Chimiques.

† *Synonymes.* Skin-bound infants; Indurcissement du tissu cellulaire; enfans dures, ou durets; enflure; enfans gelés; sclerosarques (more properly scleroderme); fœtus rigidus, &c. These and other names have been given to this disease, either from opinions which are now considered incorrect, or from variable symptoms. On this account, I hope I may be excused for employing a more suitable name, the concrete œdema, than those hitherto given.

abundant; as in the feet and legs, hands, arms, and face, the ex-
ternal genital organs, and the hypogastric region of the abdomen.
In other cases the whole body is more or less swelled.

The parts thus affected are at first soft, and evidently contain a
fluid; but they soon become hard, and are usually of a dark red
colour, mixed with a yellow tinge. The whole body feels very
cold, particularly the swelled parts, and the thermometer proves
the temperature to be very low. I found the average temperature
of several infants affected with this disease to be, in the palm of
the hand 75, at the feet 71.6, in the axilla 77.9, and between the
thighs, 75.9, (Fahr. ther.). The pulse is generally between 80
and 90 beats in a minute, but, from the weakness of the heart, and
the swelling of the cellular tissue, the pulse becomes imperceptible,
as the violence of the disease advances; the respiration is slow, and
is performed with difficulty, and a frequent weak, characteristic cry
is heard which often appears suppressed by a threatening of suffo-
cation. When the disease is severe, the infant is in general unable
to suck on account of the swelling of the cellular tissue of the face,
which prevents it opening its mouth. The tongue is commonly red
at the edges, in other cases it is covered with white aphthous ulcera-
tions; the bowels are usually relaxed.

Should the infant recover, these symptoms gradually diminish;
but in most cases, when well marked, they slowly increase, and the
patient expires a few days after the commencement of the attack.

On dissection, the cellular tissue of the swelled parts is found in-
filtered with serum, sometimes liquid, in other cases coagulated, and
more or less mixed with a yellowish coloured, granular looking sub-
stance, like hard fat, without any oleaginous admixture. This
seems to be the natural subcutaneous fat mixed with the secretion
which becomes concrete.

When the surface of the body is red, it is found on dissection to
be produced by the veins being filled with liquid blood. Those of
the internal organs are more or less distended; particularly of the
lungs, liver, spleen, and brain. This state of the brain may be
known before death, by the external redness of the face; and the
congestion in the veins in some cases proceeds to such a length, as
to produce an effusion of blood into the brain. The lungs are al-

ways found more or less distended with liquid blood, and are in a great measure impervious to air.   They are often in a state of hepatization, but in other cases are softened.   The liver and spleen are very frequently found enlarged, from the quantity of blood they contain. It is seldom that all these organs are thus distended in the same subject; but, in general, one is more affected in proportion to the healthy state of the others.

Different morbid appearances are occasionally found in dissecting the bodies of infants who have died of this disease, and which have been supposed by some to explain its nature : such as inflammation of the pleura or lungs, of the pericardium or peritoneum, aphthous affections, &c.   Such appearances are certainly not the cause of the disease, as they are often absent when the symptoms of the concrete œdema are well marked, and are not found to be in proportion to the severity of the symptoms.

The two following cases have been selected from my note book as affording examples of the severe form of this disease.

CASE I. *General swelling of the body, with concrete œdema; death.*— A large male infant, 4 days old, when brought to the hospital, was affected with swelling and hardness of the whole body, which was of a dark purple colour, mixed with a yellowish tinge.   His extremities were particularly affected ; the body was very cold.   The thorax emitted a dull sound on percussion.   He had a frequent plaintive cry ; and the swelling of the cheeks did not admit of his mouth being opened.   The pulse was imperceptible, he got gradually worse, and died three days after admission.

Dissection.—The body was swelled, very hard, and of a dark red colour, particularly evident in the face, and in large irregular patches over the trunk.   When the cellular tissue was exposed, it had a granular appearance, of a bright yellow colour, and contained a quantity of a yellowish serum.

The pericardium contained some fluid of the same colour, and its inner side was partly lined with a false membrane.   The heart and large vessels were filled with blood, particularly those of the right side.   Their surface was minutely injected, the veins containing liquid blood, more particularly the heart, where the veins were distended with blood, and the arteries empty.   The foramen ovale was not completely closed.   The lungs contained a large quantity of blood, particularly the inferior lobes.

The veins of the dura mater were distended with blood; and on cutting through the left hemisphere, a large effusion was found at the external part of the corpus striatum. At the posterior cornu of the lateral ventricle another effusion was found, which seemed to have proceeded from a rupture of some of the vessels of the plexus choroides.

The veins of the extremities were found completely gorged with dark-coloured liquid blood, but the arteries were empty.

Case II. *Hard and livid swelling of the whole body*; *death.*—A female infant, three days old, was brought to the hospital very much swelled; the whole body was livid, very cold and hard; she breathed with difficulty; pulse almost imperceptible; tongue red at the point; a discharge from the bowels, which was liquid, and of a yellowish colour. She lingered in this state for two days, and expired.

Dissection.—The cellular tissue was distended with a yellow, granular substance; when exposed some serous fluid escaped, and a number of bloody points appeared from the division of the distended veins.

The tongue was of a dark red colour, especially at the posterior part, and this redness extended to the œsophagus. The internal surface of the stomach was also red, particularly along the great curvature, where several spots of ecchymosis were found. The veins of the intestines were filled with blood; and several portions of the small intestines had a dark-red colour, like an extravasation, under the mucous surface. The liver was distended with blood. Some serum was found in the thorax; and the lungs were at several parts denser than natural. There appeared to be ecchymoses of blood under the serous surface of the pericardium; which was lined with a soft yellowish false membrane, particularly evident where it covered the lung; under it this organ appeared unusually red.

The veins and sinuses of the brain were filled with liquid blood.

Some authors have supposed that this disease is congenital, but any person examining with attention the examples on record, will find that they by no means justify such a conclusion; which is disproved by the fact that Auventy found the disease entirely unknown in the Lying-in-Hospital, when it was raging with the greatest violence in the Foundling Hospital.

The unfortunate infants in the Foundling Hospital are reared by artificial feeding, and each of them sleeps in a separate cradle, in large wards not always well-heated. The medical men of the

o

establishment are aware that nurses would be of advantage, but say that the funds are not sufficient to admit of such an additional expense. This is the more to be regretted, as there is little doubt that if the infants had nurses, this disease would not so frequently prove fatal.

In addition to these circumstances, we must recollect that in infancy the system is weak, and the power of producing animal heat so low, that it is insufficient for supporting life in the degree of cold to which they are exposed while conveying them from one hospital to the other. That this disease is produced by the exposure of the body of the tender infant to cold, is proved by the fact, that the disease is rarely seen in the summer months, while a very large proportion of infants are affected with it in the winter, when the mortality is often so high as three in ten.

The following table of the mortality from this disease at a former period in the Foundling Hospital at Paris, will give some idea of its frequency and fatal result.

Year.	Infants admitted.	Affected with concrete Œdema.	Died.
1808	4863	194	154
1809	5115	114	100
1810	4999	115	100
1811	5768	222	203

It has been alleged by some, that although this disease is so fatal in France, it is never seen in Great Britain; but the writings of Underwood, Hulm, &c., disprove such an assertion. The generality of infants are not so much exposed to the causes of this disease elsewhere as at the Foundling Hospital, and it is on this account of more rare occurrence, although it does sometimes appear, from ignorance of the prejudicial effects of cold on the health of infants inducing it.

The infants received in the workhouses of London and Westminster before the year 1767, were sent to the country to be nursed. Of these only 1 in 24 lived to be a year old, so that out of 2800, the annual number admitted, 2690 died; whereas since better measures have been adopted, only 450 out of the whole number die; and the greatest number of these deaths happen during the

three weeks the children are kept in the workhouse.—(Examination of Dr. Price's " Essay on Population," by the Rev. John Howlett, A.B.) Much of that mortality I suspect is in consequence of the neglect of the pernicious influence of cold, which has only been partially remedied.

These remarks are not less necessary in this climate, (India,) where the heat of the day is so frequently succeeded by a very cold and damp night air. The following is an example :

General dropsy of the body.—Obhychrun, aged 3 years. His father states that in July last the child's face was noticed somewhat swollen, which he supposed was produced by cold. He therefore kept the child warm, but the swelling in the course of three days increased and became general. There was a slight tendency to fever, accompanied with the symptoms of indigestion.

Afterwards a native physician saw him, and prescribed warm aperient febrifuge medicines, &c. by which the child was much relieved. He had another attack. The whole body, when first examined, was very much swollen, more particularly the extremities. The swelled parts were hard, and pitted upon pressure being made upon them. The bowels of the child were always constipated, urine scanty, and for two weeks he had a cough. Warm clothing, with frictions of oil and purgative diuretics, were prescribed in this case with great advantage.

The diagnosis of this disease is very simple. Its presence is known by the age of the patient, the swelling, which is in general hard and cold, and the state of the circulation and respiration.

The prognosis must be very guarded when the disease has not been seen at its commencement, and when the weakness, swelling, hardness, and coldness are marked. In other cases it may be different.

The various methods of treatment recommended by authors are almost entirely empirical; but if I am right in my opinion concerning its nature and cause, the advantages of the following plan of treatment may be explained. For this purpose I shall consider the treatment under the heads of curative and preventive means.

The curative indications should consist in employing artificial means for increasing animal heat, and in accelerating the action of the venous system. This will be obtained by the employment of

warm baths, particularly the sulphureous, and perhaps the exhibi-
tion internally of gentle cordials, by enveloping the body in non-
conductors, by frictions, by breathing a temperate and pure air,
and by the employment of maternal milk for food.   It is with much
pleasure I am able to add, that this plan of treatment, founded on
the preceding opinion concerning its nature, accords with that of
Dr. Baron, physician to the Foundling Hospital at Paris.

If there be symptoms of internal inflammation, bleeding may be
employed, but always with caution, as it is not borne well by in-
fants, and always tends to diminish the powers of the system,
which must be augmented as much as possible.

In most cases great benefit will be derived from the above plan of
treatment; but we must expect that in many cases it will fail,
more especially in hospitals, where so many circumstances tend to
aggravate the disease.   It is, therefore, to the preventive treatment
that medical men should direct their attention, which consists in
invigorating the system, and carefully avoiding the dangerous
effects of exposure to cold.

2. *Influence of Cold on Adults.*

When severe cold is applied to the surface of the body of an
adult, the power of generating animal heat, being considerable, pre-
vents for some time its bad effects ; but when it is very severe and
long continued, and the body weak, or in a state of exhaustion, pe-
culiar effects are produced, which we shall now proceed to con-
sider.

The first effect of such a degree of cold is that of a sedative agent ;
the skin becomes pale and shrunk, and as the effect increases the
heart becomes affected, being slower and weaker in its action, and
propels the blood with less force to the extremities.   The circula-
tion is still further diminished by the weakness of the parts, the
diminished degree of animal heat evolved, and the veins of the part
being constricted and shrunk, so that blood passes with difficulty
through them.   In such a state the surface remains pale and
shrunk.   In the extreme parts of the body, when there is a large
surface, and the person is weak, the part would often be destroyed
were it not for the non-conducting power of the skin, which prevents

the escape of animal heat, and the reaction that such a state of parts produces.

In such a case the blood is sent by the more vital arteries with greater velocity to the part, so as to resist the sedative effects of the cold, and on arriving at the veins the constricted and weakened state of the part opposes new obstacles to its progress; in consequence of which the extreme veins are slowly enlarged, and cannot empty themselves; and the part becomes red, which changes to a purple colour as the congestion increases. As the exhaling arteries which are under the heart's action secrete, while the weakened and engorged veins do not absorb, a swelling or œdema of the parts occur in the cellular tissue, among which the returning vessels arise.

This accumulated secretion diminishes the vital powers of the capillary vessels, and is the cause of the tendency to gangrene in these cases when the part is wounded.

These changes explain the phenomena related by Spooner, who, with two others, exposed their naked bodies on the top of Arthur's Seat, a mountain of considerable elevation near Edinburgh, when the temperature of the air was 32° Fahr. They found that the pulsations of the arteries became more frequent and weak in proportion to the time they remained exposed, until they were no longer felt at the wrist. One of them sat down on the snow, when he become so weak that he could not rise without assistance. During this experiment they remarked that the parts of their body in contact with the ice or snow became red and swollen, and the pulse very weak. The redness and swelling increased until they found it necessary to terminate the experiment. * " En passant les monts environ le Noël, 1537," says M. Thierry de Hery, " avec gens de guerre du roi François Iᵉʳ, plusieurs en notre troupe endurèrent telle froidure, qu'aucuns, non seulement le nez ou les oreilles, mais aussi la verge se tumifia; es uns quelque peu, es autres si véhémentement, que le cuir se dilacéroit par trop grande tension; es autres, elle s'y fit telle privation d'esprit, qu'il y eut commencement de gangrène." †

* Thomson's Lectures on Inflammation, French translation, p. 659.
† La Méthode Curatoire de la Maladie Vénérienne, p. 141. Paris.

The tumefaction in these cases depends on the congestion of blood in the veins, and, if long continued, on the accumulation of serum, as has been explained when considering the concrete œdema of infants.

As the power of generating heat is so considerable, and the means of defence of the trunk of the body prevents its being affected by ordinary degrees of cold, the following remarks refer to its effects on the extreme parts of the body. When the collapse in such parts has been considerable, the reaction is likewise severe; so that the vessels resist the sedative effects beyond the power which they possess for supporting the action of any part; and surpassing the action of strength, it becomes one of irritability, and has a strong tendency to cause mortification.

In this manner we explain those inflammations which attack the extreme parts of the body when exposed to cold, called *Chilblains*. These inflammations are liable to recur on the return of the cold weather, and produce a most painful itching, or burning sensation in the part, which is red or livid. Such parts often ulcerate.

Ribes has related the following case :—

M. D., aged 36, had been subject each winter to chilblains, which produced violent suffering each year for two or three months. During the winter of 1799 she had a violent attack, which extended to the large veins of the fore-arm, which were swelled and morbidly painful. The usual symptoms of fever came on, succeeded by those of the typhoid type, and gangrene in the hand and fore-arm. She died on the twentieth day.

On dissection, the veins were found inflamed, and contained pus from the hand to the heart. *

The peculiar nature of the inflammation produced by the reaction after exposure to cold often causes congestion and consolidation of blood in the part, more particularly in the veins. As this effect extends to a number of the vessels of the part, the general consolidation, and consequent want of circulation, produce gangrene.

When the cold is still more severe, and its effects have extended deeper, it produces frost-bite. When heat is applied externally in

* Revue Médicale, 11 année 1825, p. 70.

this state, inflammation is produced, which rapidly passes to gangrene. In countries where the temperature falls very low, when a sudden change of temperature occurs, inflammation and gangrene occur in the extreme parts of the body, which drop off. M. Larrey relates an example of this effect in the unfortunate campaign of the French in Russia. The army was exposed to all the effects of a very low temperature without any bad results occurring ; but as soon as a sudden rise in the temperature took place, a great many of the soldiers were affected with inflammation of the extreme parts of the body, which frequently terminated in gangrene.

When the cold applied to the body is still greater, its sedative effects, which first appear in the extreme parts, extend towards the trunk. The circulation becomes weaker and slower ; less and less blood is sent to the extreme parts, while a congestion takes place in the internal organs ; from the peculiar structure and situation of the brain, it becomes peculiarly affected, and an irresistible propensity to sleep occurs, when the body generates less animal heat, and quickly dies. Exercise, by increasing the generation of animal heat, is the best means of preventing this fatal result.

An example of exposure to cold may frequently be seen in the humid atmosphere of Bengal, when the radiation of caloric from the body exposed when asleep to the night air produces such a degree of cold, accompanied with a deposit of dew, as may destroy the individual, or be followed by such a degree of reaction as to produce fever. Another case is local, and is followed by local congestions and inflammations; such cases are frequently seen in this country by exposing the face to the sky, and in this state falling asleep. Radiation rapidly takes place from the exposed surface, and such a degree of cold and deposit of dew take place, as are followed by reaction, congestion and inflammation of the exposed part. As this is generally on one side of the face, it swells, with inflammation of a remittent kind, particularly of the sensible eye, and a distortion of the features of the opposite side follows. These effects are of more frequent occurrence at the full and change of the moon, and hence the supposed influence of this planet in producing cold, and according to others, her pernicious influence upon animal life.

We shall now be prepared to understand the influence of different

climates upon man ; and it is found that when the temperature
ranges between 55° and 70° of Fahr. it is the most congenial to man-
kind.   In such an atmosphere there is a considerable loss of animal
heat, which is generated quicker under these circumstances from
the energy imparted to the whole system by exercise.   In this
state the functions of organs are increased, heat is generated, and
the secretions are rendered equable and general; for during these
good effects the exposure must be less in proportion to the indi-
vidual's age and strength.

A contrary effect is produced when the body is exposed to a high
temperature, particularly when joined with moisture ; as in such
a situation little animal heat is removed from the body, and the
capillaries of the skin lose their energy and become relaxed.   In
this state copious perspirations occur, and animal heat is conveyed
away, and produces a weakness of the organs, less heat is gene-
rated, the person becomes languid, and the organs unfit for severe
or long-continued exertion.   Such changes will take place more
quickly in proportion to the strength of the system, and the power
of the organs, as more animal heat is generated to supply that
dissipated by perspiration.

Sudden changes of climate will produce a greater effect accord-
ing to the age and constitution of the person ; and such effects will
be much diminished by the influence of habit.

From the foregoing remarks the following conclusions may be
drawn :—

1. The development of animal heat is least in the infant, increases
in maturer years, and again diminishes in old age.   It is less at
the extremities of the body than at the trunk, or more internal
parts.

2. In infancy, from the highly organized skin and low animal
heat, cold must be applied with caution ; but, as the one diminishes
in sensibility, and the other increases in power, cold may be ap-
plied with more freedom.

3. As a therapeutical agent, cold may be employed with great
advantage for two opposite purposes ; as a tonic when applied in a
moderate degree, and for a short time ; or as a sedative when the
system is weak, and the degree and time during which it is applied
have been considerable.

4. To prevent the pernicious effects of cold, we must endeavour to restore the power of generating animal heat gradually, and remove the effects which have been produced.

Mechanical Obstructions to the Circulation.

When the principal venous trunk of a limb is tied in one of the inferior animals, a congestion of blood beyond the obstructed part takes place from the impeded circulation diminishing the power of the absorbent vessels, and a collection of serum in the cellular tissue of the limb is the consequence. In like manner, when the return of the blood to the heart is impeded, the functions of the extreme vessels are weakened, and unless the system be sufficiently strong to prevent the consequence of this loss of balance between the two sets of secreting and absorbing vessels, the heart propels the blood, the absorbents perform their office in an imperfect manner, and a pale, soft and compressible tumour is produced called œdema. When the veins of one side are alone affected, the swelling is confined to the same side; as may be observed in such swellings of the scrotum. An excellent example of this is related by Mr. Pott in his surgical works.

When œdema thus occurs locally, the swelling always increases first in the parts from whence the obstructed trunks arise, particularly when the cellular tissue is lax, is in considerable quantity, and is in a depending position. In this manner we learn the commencement and progress of the swelling, and in what part of the circulation the impediment is situated, and by thus detecting the cause we can more readily palliate or remove the disease.

When the cause of the obstruction is in the heart, dropsy commences in the extreme parts of the body by these weak parts being capable of resisting less the retarded circulation. It then becomes general.

When the disease is situated in the vena portæ the disease commences as ascites. When the vena cava abdominis or external iliacs are affected, the inferior extremities and scrotum become œdematous. When the principal veins of a limb are obstructed, the parts swell from which they arise.

We can thus explain the gradual progress and manner of en-

larging of these swellings.   The removal of the cause, in like man-
ner, will be followed by the disappearance of the swelling.   When
this takes place suddenly and to a considerable-extent, it sometimes
produces a quickness and difficulty of respiration, an inactivity and
sense of drowsiness, which often terminates in apoplexy and death.
These symptoms are produced by the rapidly-increased volume of
the blood, which may always be produced in the inferior animals
by injecting a large quantity of fluid into the veins.   Nature in
such cases generally throws off the superfluous fluid by increasing
some of the secretions, particularly the urine.   The same effect
may be produced artificially by removing some of the circulating
fluid.

After these general remarks on this order of dropsies, we shall
next consider their varieties.   The mechanical causes producing
dropsy may be either by unnatural growths, a displacement of
neighbouring parts pressing upon the principal trunks of veins of
a member, or these vessels being obstructed by the extension of the
inflammation from neighbouring parts to the veins.

(1.) *Pressure upon Veins produced by an unnatural growth, or the
displacement of parts.*

Mechanical obstruction in the circulation from diseases in the
heart is a frequent cause of dropsy.   These diseases are changes
in the form of the valves, the formation of polypi, &c.

The valves in such cases become less flexible, and the size of the
opening is diminished through which the blood passes ; an accu-
mulation thus takes place behind the obstruction, which increases
the action, and ultimately the strength of the organ ; this is called
hypertrophy of the heart.

As the aortic valves are most frequently the seat of disease,
from the obstruction to the circulation of the blood, this accumu-
lates in the left ventricle and auricle, and is followed by a con-
gestion of blood in the lungs, which produces quick respiration,
dyspnœa, particularly on taking exercise, hæmoptysis, &c.   Such
symptoms quickly increase to a distressing and dangerous degree,
much quicker than the hypertrophy of the heart.   But as this in-
creases, the whole nervous system becomes loaded with blood, so

that the face and extremities become livid on any excitement of the system, as by exercise. As the disease advances, the difficulty which the veins have in propelling their contents becomes more and more evident, particularly the extreme veins, where they are little supported by neighbouring parts, and when individual weakness exists. On this account the brain, lungs, liver, and spleen become often engorged; in other cases the face, but particularly the lips, become purple, the vessels of the mucous membranes of the bronchi and intestines become distended, and not unfrequently blood is evacuated from the extremities of the vessels, forming hæmoptysis, melæna, &c. In some cases these symptoms are produced by the rupture of vessels in the parts.

Such congestions predispose the part to inflammation, which, by increasing the obstruction in the capillary vessels, produces local congestions or erysipelas; this, from its peculiar nature, has a great tendency to become gangrenous. In such cases, from the general consolidation in the veins, the circulation is impeded, and it is only at particular points that any secretion takes place; as there is no absorption in such a state of vessels, small local collections of serum, modified by the diseased state of the vessels, take place, forming bullæ, so frequently seen in erysipelas.

The congestions of blood diminish the powers of absorption in a greater degree than the arterial action is weakened, and an œdematous swelling is the consequence. This takes place when the veins are least under the influence of the heart, as the face, and in particular when the blood flows against its own gravity, as at the feet and ankles.

The swelling is characterized by its soft, cold feel, and its retaining for some time the pressure of the finger; it is at first local, but becomes general when the cause is severe, or continues long. The enlargement appears first in the parts containing most cellular tissue, most distant from the heart's action, and most dependent. Hence the extremities are the parts which generally first swell, and afterwards the general cellular tissue, the serous sacs, as the peritoneum, pleura, and pericardium, until the whole system becomes so affected as to destroy the individual.

When the obstruction to the circulation of the blood through the heart takes place at the origin of the pulmonary artery, the drop-

sical symptoms are first remarked there; and it is only towards the fatal termination that dyspnœa becomes distressing.

Diseases of the liver are very frequently a cause of dropsy, by the obstruction to the circulation which they produce in that viscus. These diseases may be reduced to such chronic diseases of the liver as may produce dropsy in the cellular tissue of that organ; inflammatory diseases consolidating the blood in the branches of the vena portæ, or diseases so affecting the substance of the liver as to encroach upon and contract the veins as they pass through it.

The first and second cases follow hepatitis, and require the use of antiphlogistic remedies, with mercurial purges, &c. The third form of dropsy is most frequently produced in cases where the liver is found diminished in size, and of a hard, pale appearance. In such cases the blood appears to pass through it in smaller quantities than natural through the ramifications of the otherwise healthy vena portæ. This produces a congestion in the place, followed by dropsy of the abdomen. In the progress of such cases the accumulation of serum will be found to have commenced, and continued for a long time, confined to the abdomen, forming ascites. Towards the termination of the disease the dropsy extends to the inferior extremities.

When the disease is less acute, the swelling early in the disease only appears towards evening, from the increased stimulus and position of the body, for which reason it disappears during the night. As the progress of the disease advances, the swelling becomes permanent, and extends up the legs until the whole body is affected.

In the course of the enlargement the body becomes emaciated, hectic fever supervenes, and the patient gradually sinks. In other cases the collection of serum rapidly increases from slight imprudences, or causes increased irritation of the part, and the patient rapidly sinks from the severity of the inflammation producing it. I shall afterwards relate an interesting case of this kind of dropsy.

When the liver is studded with tumours, dropsy is not a necessary concomitant; and when it does appear, in these cases it is usually in the form of dropsy of the inferior extremities, as the vena portæ is less obstructed than the vena cava ascendens, from the pressure of the diseased liver upon it.

The enlarged *Spleen* from fever, with the consequent weakness

it produces, and the pressure it exerts upon the veins, is sometimes the cause of ascites or dropsy.

Sometimes the formation of tumours causes pressure upon the principal trunks of veins, impeding the circulation, and producing dropsy, either by consolidating or converting the blood into their own nature, or by the pressure upon them retarding their contents beyond the obstructed part. Should the collateral branches not be sufficiently large to carry off the blood, a congestion takes place beyond the obstructed part, absorption is thus impeded, and œdema produced. On account of the blood flowing against its own gravity, such partial dropsies take place more frequently in the inferior than the superior extremities. The following is a case of one of the more unusual forms of local dropsy.

CASE. *Cancerous ulceration extending to the axilla, and obliterating the axillary vein; œdema; death.*—A female, 60 years of age, had her left mamma removed on account of a cancerous disease of the part. Some time after, the disease again appeared, and after employing various remedies without any advantage, she was admitted into St. Louis's Hospital. The disease was then found to have extended to the axilla, and along the side of the thorax, where it had hard ulcerated edges, and was of a deep-red colour. The left arm was distended by an œdematous effusion, from the pressure of the tumour upon the trunks of veins of the part. The disease had proceeded so far as to exclude all hopes of advantage from an operation, and only palliatives were employed. The arm remained enlarged until her death, which occurred six weeks after admission.

Dissection forty-eight hours after death.—The left arm was enlarged by infiltration.

The right lung was hepatized, and had extensive adhesions to the side. In the pleura and pericardium a considerable quantity of serum was found.

The vena innominata was healthy, but on tracing the left subclavian vein, it was found covered with a hard tendinous fascia. On opening it to the axillary trunk, this was found to diminish gradually in size, and to terminate in an open ulcer. Several collateral branches joined the vein above the part obliterated, and communicated with those of the arm. The artery passed through the diseased mass, but it appeared very healthy. Thus the blood was sent to the extreme parts of the arm as in health, but the obliteration of the principal vein of the arm impeded absorption and the return of the blood by the veins, which was the cause of the œdema.

In this case the specific inflammation extended from the tumour which surrounded the veins to their contents; in consequence of which they were obliterated, not by the gradual encroachment of the tumour pressing on the weak vessels, but by the inflammatory disease having produced a consolidation of their contents, which, as the specific inflammation advanced, were slowly converted into a substance like that of the tumours which surrounded the vessels. In this manner we explain why the veins retained their natural size, although surrounded by malignant diseased structures; and in their advancement beyond the tumour, we see the different steps by which the veins were obliterated by the consolidation of the blood, its adhesion to the vessels, and gradual conversion into the diseased mass which surrounded them, and in this case the contraction and obliteration of the vein beyond this part. Are not such cases examples of blood becoming diseased, and that in a specific manner?

In these cases the imperfect circulation of blood in the veins prevented them from performing their functions; and the increased debility a few days before death explains the occurrence of dropsy.

This obstruction in the trunks of veins by condensed blood is a frequent cause of œdema, and is thus explained : The arteries convey the blood to all parts of the body, and perform the important offices of secretion and perspiration, while the veins and lymphatics perform absorption, and return the blood to the liver and heart. When a venous trunk is obstructed by an irritating cause, which produces a consolidation of its contents, the action of the heart and arteries remains natural, and their secretions continue, while absorption is diminished, or perhaps destroyed, and produces œdema, which will first be observed in the part where the veins arise.

Morbid Enlargements of the Pancreas, Mesentery, and other abdominal Viscera.

The pressure of tumours upon the trunks of veins is not so frequently followed by dropsy as might be supposed, as the growth of the enlargement is gradual, and it seldom impedes the circulation in a vessel which is always distended by a fluid propelled along it with considerable force.   In this manner we explain the manner in

which tumours frequently encircle the trunks of veins ; and in
other cases when the advancement of the tumour is more rapid, so
as to encroach on the vein, collateral trunks or branches carry on
the circulation, and no congestion or œdema is produced beyond
the part obstructed. Hence the trunk of a vein may be obstructed,
as of the jugular vein, and the blood be returned by the vein of the
opposite side ; or the deep-seated trunks or veins may be rendered
impervious, and the external branches carry on the circulation. It
is for this reason that the varicose state of the veins distributed
over a tumour forms an important diagnostic sign of the rapid
growth of new structure. This obstructs the vessels of the part,
and thus indicates the malignant nature of the tumour. When
the laxity of the parts allows the enlargement of the swelling, the
obstruction of the vessels is frequently prevented. In a case of this
kind, in which the tumour had enveloped the penis, and terminated
in a large ulceration in the groin, the crural vessels were found
healthy, and of their natural size, although surrounded for a con-
siderable distance by a large mass of disease. The tumour in this
case was very vascular, and no œdema preceded death. The ab-
sence of such a consequence was most probably owing to the per-
son being a strong middle-aged man, and his being little weak-
ened. The collateral branches enlarged, free circulation took place
through the tumour, and dropsy was thus prevented.

Mesenteric glands are often found much enlarged, and frequently
produce dropsy of the inferior extremities.

When tumours of a malignant nature form in the lungs, such as
fungus hæmatodes, melanosis, and other new growths, they most
generally end by causing an effusion of serum into the cavity of the
chest. This is produced by their impeding the circulation through
the pulmonary vessels ; but a more frequent cause of such obstruc-
tion to the transmission of blood through the lungs is produced by
previous attacks of inflammation and thickening of the organ.

In all such cases of obstruction, dropsy is always most liable to
be produced when the person is weak. In this state the trunks of
veins afford less obstruction to the encroachment of the swelling,
the collateral circulation is imperfectly performed, and absorption
is weak, while the secretions are little altered in their power.

The progress of deep-seated collections of matter towards the

surface sometimes produces such pressure upon the veins in their neighbourhood as to be followed by dropsy. Lumbar abscesses sometimes produce this effect.

Aneurisms as they enlarge sometimes obstruct and obliterate venous trunks in their neighbourhood. Mr. Hunter saw one which almost completely obstructed the superior vena cava, and the left brachio-basilic veins. Bertin saw another case in which several aneurismal tumours at the arch of the aorta compressed the vena cava superior, and produced œdema of the face, and several attacks of apoplexy. Corvisart had seen a similar case.

My friend M. J. Cloquet showed me a drawing of an interesting case in which the vena cava abdominis was almost obliterated, and œdema of the inferior extremities produced by a large calculus, which had become encysted in its descent from the kidney to the bladder. The obstructed vein was found filled with a coagulum, and the collateral veins were in a varicose state. In another case a femoral hernia in its descent passed between the crural artery and vein, compressing the first, and almost obliterating the last.

A part of the artery, when the swelling had pressed upon it, was changed to a white cartilaginous structure, and a large varix was found in the femoral vein where it joins the crural. The enlarged *gravid uterus*, pressing upon the trunks of veins as they pass near it, is a very frequent cause of œdema of the inferior extremities, which is prevented from producing any bad consequences by position, frictions upwards, &c., until the obstructing cause is removed.

In all such cases of dropsy the skin is pale and dry, and the secretions diminished, the patient also complains of thirst, languor, and weakness. The bowels are constipated, the dejections scanty, and of a pale or white colour. The blood is of a pale colour, and the crassamentum soft ; the urine is high-coloured and scanty, and deposits a red sediment. It does not coagulate by heat. As the swelling increases the movements of the diaphragm are impeded, and dyspnœa, &c. is produced.

(2.) *Obstruction of Venous Trunks from the consolidation of Blood.*

When inflammation occurs in the neighbourhood of trunks of veins, it does not always extend to these vessels ; in consequence of their coats having so little vitality, and from the continual change of the large quantity of blood passing through them. But in some cases, from the extent and violence of the inflammation, or rather from the predisposition of the vessels to be so affected, a consolidation of the blood takes place, and the impeded circulation produces dropsy of the part beyond the obstruction ; from the slower progress of blood in the veins of the inferior extremities they are more liable to be thus inflamed than those of other parts of the body. The most frequent and dangerous form of dropsy so produced is that after delivery, called *phlegmasia dolens,* which has been already considered, although it differs from the generality of dropsies in consequence of its acute nature, and the consequent unusual quantity of the coagulable principle effused.

In all such cases the principal trunks must be affected before any great accumulation can take place beyond the obstructed part ; as there is such an intimate communication, and such a power in nature of enlarging collateral branches, that it frequently happens that large trunks are obliterated, and the circulation continues by means of the collateral branches without dropsy occurring.

The trunks of veins are in other cases obstructed by the rapid enlargement of vascular tumours round them, which extend to the vessels, consolidating their contents, and converting these into the peculiar nature of the surrounding disease. In this manner large trunks of veins are often obstructed, and produce dropsy of the part from which the branches arose.

CASE.—A man, 70 years of age, had been affected for a considerable time before admission into hospital with a large tumour, of a hard tuberculated form, in the left groin, which was attended with such severe lancinating pains as prevented him sleeping for some time before admission. He was much emaciated, had no appetite, and his left leg was distended with an œdematous swelling. Several days after death, which occurred soon after admission, the right leg became dropsical.

P

Dissection.—Several small adhesions were found between the pleura pulmonalis and costalis, and several ounces of a yellowish serum were found in the left sac of the pleura. The lungs were healthy. Several ounces of a sanguineous serum were found in the pericardium ; the heart was large and flabby, and its right cavities were filled with dark-coloured semi-coagulated blood.

When the abdomen was exposed, a large diseased spleen was first remarked. It was thrice the natural size ; and on dividing it, it was found to be composed of a scirrhous structure, intermixed with portions of a dark-coloured substance, and surrounded by the healthy-looking structure of the organ. The pancreas was enlarged, and partially converted into a yellowish cerebriform matter.

The stomach adhered intimately to the diseased spleen ; its villous coat was thickened, of a soft yellowish colour, and highly injected.

The tumour in the groin was of a pyramidal form, about the size of a fist, and situated under the fascia lata femoris. Several enlarged glands appeared on the surface of the tumour, and an oval-formed swelling, about the size of a pullet's egg, formed the apex of the large mass of disease, and had a cerebriform appearance, whilst the rest of the enlargement had a cartilaginous hardness, and strongly adhered to Poupart's ligament and the horizontal branch of the pubis. The disease extended to the mesenteric glands, which were partially converted into a large, hard cartilaginous mass, mixed with cerebriform matter, and a dark-bluish substance.

The veins of the left leg, from the foot to the termination of the external and internal iliacs in the common iliac veins, were filled with changed consolidated blood. At the upper part of the thigh, where the venous trunks were surrounded by the tumour, they were filled with a hard fibrous matter, which on careful examination, assisted by maceration, &c. was found to resemble the hard yellowish mixed with dark-bluish matter which was found in the spleen and mesenteric tumour. The calibre of the veins appeared a little smaller than those of the right side ; and this difference became better marked lower down in the thigh, At this part the consolidated blood appeared more recent, but seemed contracted at different points, and at others formed oval tuberculated-looking enlargements, which appeared covered with a thin transparent membrane very slightly attached to the internal membrane of the vein.

On the right side the femoral vein was found filled partly with an irregular mass of recently coagulated, or rather consolidated blood, which formed enlargements at the valves of the vessel. It was easily removed from the vein, the internal membrane of which seemed quite healthy, as well as those branches which arose below this part.

The arteries were partially ossified. Many of the lymphatic glands were enlarged and inflamed; but after a careful examination, nothing morbid could be discovered in the thoracic duct.

These appearances in the veins explain the œdema in the two sides: in one the obstruction was old, the œdema having existed long; while on the other side the consolidation had been recent, and the collection of serum only showed itself a short time before death.

In such cases of malignant tumours there is a strong tendency to inflammation, which must be diminished by proper remedies and avoiding all irritating causes. The following case affords an example of the danger of using an opposite course of treatment.

CASE.—Thomas Allan, æt. 55, was admitted into hospital in consequence of dropsy, particularly affecting the abdomen. His skin was yellow, he had a haggard expression of face, and was so weak that it was not supposed he would live till morning. Various diuretics, with small doses of calomel, were given without much benefit; and as the ascites had increased considerably, the operation of paracentesis was ordered, and a large pail of yellowish serum was removed.

Nov. 18*th.*—I found the patient's expression of face very anxious, with a deep tinge of yellow in the skin. He informed me it was the first time the operation had been performed.

21*st.*—Has still a very anxious appearance, his breathing hurried, but does not complain of pain. Four ounces of wine have been given him by the family physician.

22*nd.*—Was suddenly called to see this patient in consequence of his having been attacked with rigors. Pulse small, hard, and very frequent; the abdomen is very much distended.

He died during the night,

Dissection.—The abdomen appeared as large as before the operation, from the accumulation of serum.

Peritoneum highly inflamed, with numerous small vessels ramifying under its surface. The epiplon thickened and inflamed. The mucous membrane was generally inflamed from the stomach to the rectum, spots, with streaks of red, appearing on the valvulæ coniventes and large intestines, and the appendices epiploicæ being of a red colour.

The pericardium contained a couple of ounces of yellowish serum, and where this membrane covered the heart it appeared inflamed, particularly over the right auricle, where a considerable quantity of a soft purulent

substance had been secreted.   Old adhesions united the pleura costalis to
the pleura pulmonalis.   The lungs appeared healthy.   Where the vena
innominata joined the vena cava descendens, an oval hard tumour, the size
of a duck's egg, was found pressing upon and diminishing the calibre of the
venous trunks, as also the ascending aorta and arteria innominata.   When
cut into, this tumour appeared to be composed of the same hard partly
cartilaginous fungoid tumour as that found in the liver.   The lower part
of the mucous membrane of the trachea and commencement of the bronchia
was of a dark-red colour, and considerably swelled by serum.

   The liver appeared smaller than usual, was of a light-grey or ash-colour,
felt hard, and presented on its surface light-coloured projecting tubercu-
lated masses, with numerous vessels ramifying upon their surfaces.   The
trunk of the vena portæ, when opened, appeared smaller than natural,
and became still more apparent as it passed through the pancreas, which
seemed enlarged and indurated.   On following one of the trunks of the
vena portæ, it was found to be filled with a granular-looking coagulum,
but this did not adhere to its internal membrane, which seemed healthy and
pervious.   The second trunk of this vessel was slit open, and after removing
the same kind of coagulum, which was situated at its commencement, the
vein was found completely filled by a fungous-looking substance, that
had a reddish tinge, particularly round its lobulated extremity.   When the
trunk was exposed to the extremities, its branches were found completely
filled with the same substance, until it terminated in one of the large tu-
mours which were seen externally, and which was found to penetrate deep
into the substance of the liver.   They had a granular appearance, and near
their centre a cartilaginous mass appeared, of an irregular figure, and that
seemed to be lost in the softer mass which surrounded it.   The other
branches of the vein belonging to the same lobe were found distended with
the diseased mass, and some of them could be traced through the more
healthy structure of the liver to the surface, where insolated tumours of
the same description were found ; while other branches, likewise distended
with the tumour, terminated in bulbous extremities.

   The trunk of the vein from the right lobe of the liver was pervious, but
near its origin a coagulum was found only attached to the internal coat of
the vein at one point, where a number of vessels appeared to be given off
and distributed upon the tumour, which was tough, of a yellowish colour,
and appeared evidently to be taking on the structure of the other tumours.
At the commencement of a third trunk of the vein, a yellow, granulating,
unattached substance filled the vessel, and appeared to be taking on the
same diseased structure as the tumour in the liver.

Nothing was known of the history of this interesting case. The disease appears, however, to have commenced as a malignant tumour in the liver, which slowly affected the system, and produced permanent jaundice. By some imprudence, or by the progress of the tumour to softening, the severe inflammatory diathesis was produced, and this, aggravated by the operation of paracentesis, hastened the individual's death.

The blood had consolidated, and it appeared to have extended from the diseased tumour to the trunk of the veins, and from these extended to other branches which ramified upon healthy parts of the liver. The changes that the blood appeared to undergo was its consolidation by the influence of the specific inflammation, and its conversion into a similar structure. The impervious vena portæ explains the occurrence of ascites, which was increased after the operation for withdrawing the serum, by the irritation it caused.

The bronchial tumour did not seem to produce œdema, as it appeared to press on both the arteries and veins ; but had it been allowed to increase it would have pressed more upon the yielding veins than the arteries, and dropsy would have been the consequence.

In the treatment of this form of dropsy, the indications are, to combat dangerous symptoms, to remove the cause, and to promote the re-absorption of the effused serum. This is done in acute cases by lowering the sthenic state of the body, by increasing other secretions, more particularly of the mucous membranes ; or, if the accumulation of serum be so great as to produce distressing symptoms, and impede absorption, the serum must be removed by scarifying the part, and then using remedies to diminish the influence of the cause.

As the cause of dropsy must vary the treatment, I have also considered this under the three classes of causes ;—when the circulation is impeded, when inflammation and when debility are present. Here I have to speak of the treatment when mechanical obstruction is the cause of dropsy.

When the cause of dropsy depends on a disease of the heart, the dropsy is only to be considered as a symptom ; and an indication of treatment should be directed to mitigate the disease in the heart by diminishing the mass of the circulating fluid. This is to be

done by frequent small bleedings, by diminishing the quantity of liquids, by laxative medicines, by the use of digitalis, and other diuretic medicines.   When other internal organs produce dropsy, our attention must be directed to the removal of the cause, while its effects are prevented by assisting the flow of the venous blood, by pressure or friction of the part, by promoting absorption, increasing the tonic action of other secreting organs which are more or less obstructed, and by increasing the secretion of the kidneys and bowels.   This last indication will be particularly advantageous when it is ascites.   In hydrothorax it will be less so, and more advantage will be obtained from chalybeates.

For obtaining these different indications the use of blue pill will be of great advantage, by assisting absorption ; and for assisting the action of purgatives, sudorifics and diuretics, as squills, digitalis, nitrous aether, liquor ammon. acetatis, &c.   These remedies must be changed from time to time, and generally continued for a long time.

When the liver is the part affected, mercurials mixed with digitalis, squills, or purgatives, and nitro-muriatic acid in decoction, with sarsaparilla, may be combined with alterative doses of blue pill.

In such cases it must be recollected that the mercurial remedies ought not to be carried so far as to affect the general system, and thus produce a debilitating effect, as this will increase the tendency to dropsy.

Some cases of this form of dropsy take on an active form, accompanied with such sudden and great increase to the effusion as to produce most distressing symptoms of anxiety, difficulty of breathing, &c.   In such cases the acute symptoms are to be subdued by active antiphlogistic remedies, followed by the exhibition of drastic purgatives, such as calomel, elaterium, croton oil, gamboge, &c.

I have observed more than one interesting case of this kind of dropsy which rapidly proved fatal by neglecting antiphlogistic remedies, using stimulants, and having recourse to the operation of paracentesis.

In many cases the physician does not see the patient until the accumulation of serum has increased so much, and in other cases

the cause is so powerful, that the swelling has increased to a great size. In such cases it is necessary to remove the serum by an artificial opening, so as to allow the parts to be restored to their natural state, when the absorbents will be more easily made to act, and the cause of the dropsy treated with a far greater chance of success.

In making openings to allow the escape of accumulations of serum, we must bear in mind that the circulation in such parts is very imperfect; as the slowness of the progress of the blood in the veins, and their small number, render them liable to be attacked with erysipelas on being irritated, which, from the weak and impeded circulation, are liable to become gangrenous, particularly when parts at a distance from the heart are so affected. To prevent such distressing results, the scarifications are to be performed where the circulation is most under the influence of the heart's action, and where the part is most vascular.

When erysipelas attacks such wounds, we must have recourse to bleeding according to the strength of the system. Much benefit is obtained by such an evacuation, and the dark-red colour which the consolidated blood in the capillaries produces changes to a more florid appearance, when it terminates by a resolution. Several such examples are related by Andral, in his " Clinique Médicale," p. 499.

Another temporary means of relief is obtained by tapping, which is of importance in relieving the distressing symptoms of distention, and allowing time for the employment of remedies in chronic cases ; but in the acute and subacute form it should very rarely be had recourse to, as it increases the cause of disease, and thus hastens its fatal course. We must however recollect, that when the cause is acute it must first be attacked ; if of an inflammatory nature this must be reduced, and the tapping performed, or otherwise the irritation will increase the disease, and the serum will again accumulate.

SECTION III.

Dropsy produced by Debility.

When the system is much debilitated, the circulation is not everywhere affected in the same way, as it varies with the situation and

functions of the part affected.   After long and dangerous illnesses,
as fevers, organic diseases, frequent salivations, and certain cuta-
neous diseases, as scarlatina, in which the capillary circulation is
unusually active, the system is left exhausted, in which case the
veins are more affected than the arteries.   The same kind of de-
bility may be produced by excessive and long-continued evacua-
tions, or the free use of spirituous liquors, by which the digestive
powers are weakened, the nervous influence much debilitated, and
the muscles of organic and animal life are much diminished in size
and power.   The muscles of animal life are soon tired, and the
heart in like manner sends the diminished volume more quickly to
the extremities to make up for its weakness.   In such cases, the
arteries, from being under the direct influence of the heart, are
affected less in their functions than the veins, more particularly
those that are at the greatest distance from the heart, and return
the blood against its own gravity, and where the balance of the cir-
culation is easiest broken.

In some cases this local predisposition may be increased in cer-
tain states of the system, and thus produce local accumulations of
serum.   Hydrocele is the most common effect of such a cause.

Whatever debilitates the general system tends to produce dropsy,
by the nervous system being more affected than the arterial vessels,
by which the balance of the circulation and of the secreting and
absorbing vessels is broken.   The debility which is produced in the
absorbing vessels unfits them for removing the superfluous secre-
tion, and œdema is the consequence.   The same thing may follow
by any unusual exertion when in a state of debility, which termi-
nates in anasarca and death.

In the ungenial climate of Bengal the body is much debilitated;
and so great is the heat during part of the year, that little exercise
is taken.   In such a state a painful heat in the soles of the feet is
of frequent occurrence, with an œdematous swelling round the
ankles when the lower extremities are allowed to hang down.
These symptoms are mitigated by raising the feet to a horizontal
position, and by frictions, which are frequently had recourse to.
The one prevents the stagnation of the contents of veins, and the
other assists their circulation.   In this manner we explain the Ori-
ental custom of reclining upon sofas, and sitting with the legs bent
upon a carpet on the floor.

These causes of debility are often increased by disease. Menor-
rhagia is a frequent complaint of the European female in India;
and sometimes the discharge is of pure blood. The debility so
produced shows itself by the œdema first appearing in the inferior
extremities. Dyspepsia is another frequent cause of dropsy in
this country, with the usual distressing symptoms. In some cases
the climate produces a general debility, without any of the viscera
being prominently affected. The person loses flesh, becomes debi-
litated in body and mind, and the pulse full, slow, and sometimes
irregular. In these cases the feet first swell after hanging down
for some time. As the disease advances, unless a change of climate
is had recourse to, the swelling of the feet becomes permanent, and
extends to the other parts of the body, the weakness increases with
the dropsy, and the patient sinks exhausted by the aggravated de-
bility.

After severe diseases dropsy frequently appears in their last
stage; by the sympathy which exists between the skin and the mu-
cous membrane of the intestines, it likewise shows itself when this
tissue is diseased, as in dysentery, after it has made great progress,
and in the last stage of fatal diseases producing great debility,
which would seem to have been the cause of the dropsy in such
circumstances.

In children, from derangements in the primæ viæ, and the un-
healthy influence of the weather during the rains, anasarca is some-
times produced. In such cases the feet and hands are the parts
first affected, and the treatment requires to be directed to the re-
moval of the cause, which is often an organic disease.

In this morbid accumulation of serum, first in the pending extre-
mities after they have hung down for some time, and afterwards in
the general cellular tissue over the body, the tumefaction is soft
and inelastic, and when pressed upon with the finger, retains its
mark for some time, while the skin becomes paler than usual. By
degrees the swelling ascends, and occupies the trunk of the body,
extending to the face and eyelids, which appear full, yellow and
bloated. The breathing becomes difficult, the perspiration much
obstructed, the body emaciated, great thirst, bowels costive, while
the urine is in small quantity, high-coloured, and deposits a reddish
sediment. To these symptoms succeed torpor, heaviness, trouble-

some cough, and when the person has a good constitution, a degree of low fever. In some cases the serum oozes out of the pores of the cuticle, in others the skin bursts, while in many cases gangrenous spots precede the fatal termination.

The treatment of dropsy when produced by debility will require attention to the removal of the cause; and as this is often debility, if it be only removed, the symptoms of dropsy likewise disappear. In other cases of this species of dropsy, a little medicine to retard the heart's action, and to promote the secretion of urine, will quickly remove the swelling. Should there be hemorrhage, menorrhagy, diarrhœa, &c., the treatment must first be directed principally to remove these diseases, which are the cause of the dropsy, and which will then be remedied by strengthening the system.

When the more urgent symptoms of dropsy have been removed, the system must be improved by tonic medicines, and by nourishing and easily-digested food ; while the swelling should be checked in its progress by diuretics, purgatives, and tonics, as bitters and preparations of iron. The ferrum tartarizatum, being a diuretic as well as a tonic, is the mildest and one of the most efficacious preparations of steel. When the disease begins to diminish, such exercise as the patient can take in the open air without fatigue, with any other means to improve the general health, ought not to be neglected.

When the collection of fluid is such as to disturb the more important functions, a few small scarifications may be made with a lancet, not too near each other, nor below the knee or elbow-joints. Absorption may be promoted by frictions with oil, and a methodical pressure upon the part.

CHAPTER II.

ACUTE OR DIRECT CAUSES OF DROPSY.

It has been already remarked, that when inflammation attacks a part, one of its first effects is to produce a consolidation of blood in the vessel so affected. The consequences of the obstruction to the large venous trunks explain the manner in which a like ob-

struction in the minute vessels should produce the same effect, modified by the peculiar offices of the part. The increased propelling force of the secreting vessels of the part, which are under the influence of the heart, pours out more of their peculiar fluid than the absorbents can remove, obstructed in the return of the blood by the veins; and its quality will likewise be modified with the intensity of the cause. When a large serous sac is so affected, an increase to the usual lubricating secretion takes place; but should the irritation be severe, the fluid will contain flocculi of lymph, and may be more or less coagulated by exposure to heat, from the quantity of albumen, &c. it contains; in the same manner local inflammation of the cellular tissue is more or less hard, according to the severity of the cause, the constitution of the individual, &c.

The varieties in the situation and nature of these swellings from different degrees of inflammation will now be considered.

SECTION I.

General Effects of Inflammation upon the Functions of Secretion and Absorption.

When an external part is inflamed, the tumefaction will vary in degree and kind with the function, tissue and situation of the part affected, the age, strength of the constitution, state of the blood-vessels of the part, and the severity of the cause. When the inflammation is slight, the secretion into the cellular membrane is increased, and an œdematous appearance is produced from the increased action of the secreting, and the impeded and debilitated effect of the absorbent vessels. This is likewise seen in the large proportion of serum in the blood after different bleedings, and after long diseases, when the swelling has always a serous character. When the inflammation is more acute, the blood contains more of the solid part, which is secreted in larger quantities in proportion to the severity of the inflammation. This influence of degree is seen in local inflammation, by the diminution from the hard central point to its circumference, around which and at the most depending point a degree of œdematous enlargement may be observed, which is amongst the first symptoms that appears on a part

becoming inflamed, and likewise when the disease diminishes.   As there are several other diseases, the nature of which I believe is not properly understood, so they have received different names, according to the age of the individual, the part attacked, and country in which they are most commonly found, rather than by considering that they are produced by the same causes, are of the same nature, and require similar indications to be fulfilled for their cure.   A few remarks will now be added regarding these diseases, and the reasons why they may be considered as the same disease, modified by the circumstances of the case.

Dropsy is produced by the increased action of one part of the arterial system more than another.

The occurrence of primary and idiopathic dropsy, as it takes place in inflamed serous or cellular tissue, is explained in the same manner as the occurrence of swelling in inflamed parts; as the congestion of venous blood, from its partial consolidation, impedes absorption when the action of the secretory vessels is increased by an irritating effect short of inflammation.   The higher state of organization in this tissue renders it more liable to the acute and local accumulation of the secretion in the part, which is hard and red ; while serous sacs are more generally affected with inflammation from the free communication of the vessels, which produces an increased secretion of serous fluid containing different proportions of coagulable lymph, according to the severity of the inflammation.

These cases of dropsy may be divided into general and local.

Acute General Dropsy, or Anasarca.

Such cases of dropsy occur from the increased actions of the arteries, which, during convalescence from long diseases, seem to be left, like those of young people, predominating over the venous system, so as to supply the waste which the system has undergone during disease.

It is likewise a means employed by nature to relieve the oppression in the circulation of the part; and on that account it has a tendency to increase the secretion from limited spots.

A frequent example of this kind of dropsy follows exanthematous

diseases, especially scarlatina, measles and some pustular forms, urticaria, purpura, &c.

The anasarca usually occurs before the complete recovery from scarlatina, from the debility of the system, the peculiar non-perspirable state of the skin when desquamating, and the sort of inflammatory diathesis, which is either local or general. In these cases it commences by a puffiness of the face, which in a day or two extends over the body, particularly the upper extremities, from the greater power or force of the vessels at these parts, than at a greater distance from the heart. This general effect is in consequence of none of the organs being particularly affected or predisposed to diseases.

In many cases, particularly those recorded by Dr. Abercrombie and Dr. Blackall, this form of anasarca commences in the pleura and lungs, from whence it extends over the body. It is often accompanied with sickness and vomiting, and frequently affects the extremities, more particularly the upper extremities and face. The brain in some cases is so much affected, that the pressure produces torpor.

Another class of causes which produce anasarca is drinking cold water, or exposure to cold, when hot and perspiring; by which a repulsion of cutaneous eruptions, suppression of the catamenia, or other discharges, &c. follow.

In these cases the urine coagulates by the application of heat, the blood has a buff, the pulse is frequent and strong, and in others it is irregular or intermits.

These symptoms indicate the propriety of depletion, which is proved by the great advantage obtained from bleeding and purging, when the disease has proceeded so far that the inflammatory symptoms have given place to those of apparent debility. In such cases great advantage is obtained from the use of diuretics, such as digitalis, &c.

By such irregularities in the habitual discharges, a plethora is produced by their suppression. In some of these cases of suppression of the catamenia, the œdema of the extremities is accompanied with a tenderness in the veins for an inch or two from the groin, which generally yields to the application of leeches to the part that is pained. In other cases the cord-like feel of the vein

from the groin to its passage through the tendon of the triceps muscle is marked.

The irregularity and cessation of the menses is sometimes followed by dropsy, which is explained in the same manner.

When dropsy is produced by inflammation in a serous membrane, it is more diffuse than inflammation in other tissues, and does not run through the same stages as that of serous tissue. A largely increased secretion of serum occurs, mixed with more or less lymph, according to the severity of the inflammation. The serous membrane, when so affected, loses its transparency, has patches or red spots, and is covered with shreds and masses of coagulable lymph. This appearance will be considerably modified by the time the patient lives after the attack, and the remedies employed, as the acute stage will be diminished or disappear.

The nature of the secretion will be modified by the cause and degree of the inflammation. The quantity of albuminous matter is in proportion to the acuteness of the symptoms. Hence the secretion of serum and coagulable lymph are different degrees of the same affection, and suppuration is a still higher degree of the same cause. The situation modifies these secretions : in the ventricles of the brain the serum is limpid, or it is a yellowish jelly diffused upon the external surface of the brain ; in the pleura and peritoneum the serous fluid is yellow, greenish, or red.

Such varieties of the effusion in dropsy may be reduced to the following heads :—

1. It is a pellucid serum.

2. Serum which has various degrees of colour, from a light citrine to a deep brown.

3. In which the serum is more or less mixed with a substance of the consistence of jelly, which coagulates on exposure to a certain degree of cold or heat.

4. Serum mixed with more or less flocculi of coagulable lymph ; and,

5. Serum mixed with blood more or less changed, or pus.

Dr. Blackall's test of the coagulation of urine by heat, as proving the sthenic nature of the disease, although it is correct, and is of much importance to know, still many cases of dropsy that are produced by a local inflammatory cause, and require antiphlogistic

remedies, do not show coagulated urine, as the system is not suf-
ciently excited, or because it is excessively debilitated. We may
therefore conclude that the test is not available in all cases re-
quiring bleeding; but when it is seen, this evacuation may be
employed to a certain degree, according to the nature of the
case.

SECTION II.

Acute Local Dropsy.

This will be considered under the heads Thorax, Abdomen, and
Scrotum. The most simple form of local dropsy occurs when the
secreting surface of the skin or corion is irritated, as by a blister,
by a burn, by some cutaneous diseases, as pemphigus, &c. In
such cases the secreted fluid is most commonly serum, and the
cuticle is raised in the form of blisters or bullæ of different sizes.
When the irritating cause is more severe, a considerable secretion
takes place under the cuticle of serum mixed with flakes of lymph,
or pus; and if the cuticle be hard and strong, I have seen con-
siderable pain produced by the distention of the part, and the un-
yielding nature of the covering. When such a swelling is punc-
tured, a quantity of serum and pus flows out, with great relief to
the pain, and the irritation quickly disappears.

The stings of many venomous insects in Bengal produce an itch-
ing or severe burning pain in the part. When this is examined, a
small point may be observed, with a slight redness round it. This
is almost immediately followed by a considerable swelling; and so
suddenly does this take place, that I have seen the finger of a lady
swell so rapidly after this accident, that she had not time to remove
a ring which increased the irritation. When the cellular tissue is
in considerable quantities, and lax, the swelling is greater, but
without any redness or sensibility.

In examining the changes which occur in the skin when it is
highly inflamed, we find that the part affected does not perspire ;
but as the irritation diminishes, the perspiration returns. In like
manner the skin is dry and hard during the acute stage of fever ;
but as this diminishes, perspiration becomes more copious. The

degree of tone in the vessels affected changes that of the perspira-
tion, so that as the fever diminishes, and the tone of the vessels and
activity in the circulation are weakened, that of the perspiration is
increased, and hæmorrhages are most liable to occur.   These take
place where there is least covering to the corion, as from the nose,
mouth, vagina, &c.   The bleeding in dysentery is a proof of the
degree of inflammation present, and is to be considered as an ex-
ception to the above rule.

Dropsy sometimes takes place from subacute inflammation of
the membrane affected.   In this case the serum is generally mixed
with lymph in proportion to the severity of the inflammation.

I shall now proceed to make a few remarks on the occurrence
of dropsy in different parts of the body under this head, as this
acute form is the most usual one in which the disease is found
in the two classes of tissues in which dropsy occurs, viz., the
cellular and serous.   These remarks will be arranged under the
separate heads of Dropsy of the Head, Thorax, Abdomen and ex-
tremities.

Dropsy of the Head and Spine.

Before considering these diseases, I shall make a few remarks
on the nature and structure of the arachnoid membrane.

The structure and use of the arachnoid membrane prove that it
is a serous tissue modified for the peculiar functions it performs,
as the delicate brain requires a fine membrane to surround and sepa-
rate its parts ; on this account its circumvolutions are followed
with difficulty, and different opinions have been recorded concern-
ing the arachnoid.   It appears most probable that the layer of this
membrane which covers the hemispheres is reflected into the an-
fractuosities of the brain to form what is called the pia mater, while
the outer layer of the arachnoid is reflected over the dura mater.
In this manner two sacs are formed which are more or less inti-
mately connected in individual cases, and become very evident in
cases of an accumulation of the secretion with which they are
lubricated during life.

These duplications pass to the lateral ventricles at the posterior
and lower part of the corpus callosum, and after lining the ventri-

cles, and forming the plexus choroides, descends to the fourth ventricle, and again unites with the membrane as it lines the external surface of the cerebrum, continues along the spinal marrow, lining the internal surface of the theca vertebralis and spinal marrow; and by the tucking up of the arachnoid membrane it forms the ligamentum dentatum, so as to admit the movements of the vertebral column without injuring the spinal marrow.

This variety of dropsy will be considered under diseases of the arachnoid membrane, of the brain and of the spinal marrow.

Dropsy of the brain, or hydrocephalus, has been considered under the congenital and acquired forms ; but as the causes and consequences of these types are the same, I prefer the distinction into External and Internal Hydrocephalus.

Hydrocephalus Externus.

In the animal economy the vessels are more numerous in proportion to the necessity and functions of the part ; and they change in number and activity in different periods of life, to modify these changes in the functions. In infancy a much larger proportion of blood is sent to the brain than in the adult, which nourishes and quickly brings the brain to its natural size ; but when diseases occur, more blood is sent to the membranes, while absorption is imperfectly performed, and an accumulation of serum is the consequence, more particularly in the ventricles and on the external surface of the hemispheres. This is not in general so well-marked, from being not so highly organized, and in general only secretes enough to lubricate the surface. In some rare cases, however, the vessels of particular parts are sometimes increased in their secretions, and local and external accumulations may thus occur. The following is a case of external hydrocephalus.

CASE.—Gunner Baker, a young recruit, had received a severe injury of the head from a fall when very young, from which time he had been subject to severe headaches, which were increased when he came to Bengal. He was attacked with the remittent fever of the country, with determination to the head, of which he died on the eleventh day.

On examining the brain, a cavity was found in the superior lobe of the right hemisphere two inches long, one inch broad, and half an inch deep,

Q

containing serum. On examining the cavity with care, it was found to be contained between the arachnoid folds, the smooth surface extending over the anfractuosities without entering between them. Around its edge it was firmly fixed, so that it appeared to form a complete interrupted sac, which was intimately connected with the dura mater. The membranes of the brain were thickened and evidently inflamed; more red points were found than usual when the brain was divided across, and several ounces of serum were found in the ventricles. There was no depression in the skull opposite the deficiency in the brain.

The vascularity of the brain and the thickening and opacity of its membranes, with the quantity of serum it contained, seemed to prove that these appearances were produced by a recent determination of blood; but this could not have produced the collection of serum. Probably in consequence of the injury in his youth, he was attacked originally by hydrocephalus, of which he recovered, leaving the collection of serum, which probably slowly diminished. It was situated between the arachnoid and dura mater; of a much larger size once, it contracted adhesions round the edges, and the brain became accustomed to its presence. Such an opinion may appear at variance with the supposition that the brain gives form to the skull; but in consequence of the growth of the bones of the head, and the situation of the collection of serum, we may suppose that the cavity offered a resistance, in consequence of the fluid which it contained, and that the ossification of the skull followed the natural curved form.

Hydrocephalus Internus.

This disease is either acute or chronic.

The acute form of hydrocephalus is produced by any cause increasing the secretion of serum, and diminishing or not altering the absorption. In the more chronic form, this disease is produced by derangements of the system, whether by irregularity of diet, or by a scrofulous tendency.

By these causes an accumulation of serum takes place into the arachnoid membrane of the ventricles. The symptoms accompanying the acute form of this disease are remittent fever, having the accession in the evening and night, a determination of blood to

the head causing headache and languor and disinclination to every kind of exertion, stupor, intolerance of light and contraction of the pupils, followed by dullness of sight and dilatation of the pupils. Sometimes these premonitory symptoms are absent, and the disease is ushered in by convulsions. The patient often starts in his sleep, and screams as if frightened, he has grinding of the teeth, followed by strabismus, convulsions, and dilatation of the pupils. The child is frequently affected with inclination to vomit, his bowels are irregular and generally costive. The pulse in the first stage is frequent; but in the second stage it becomes feeble, irregular, slow, intermittent, and easily quickened.

A child seven months old had commenced teething, and the stomach got out of order. The symptoms were sufficiently marked, but a French physician who attended did not heed them, and even when the drowsiness, affection of the pupil, and convulsions occurred, a little magnesia and a leech on the scrobiculis cordis were the only remedies employed. The child soon sunk.

I was requested to be present at the dissection. The body was that of a strong healthy child, and all the viscera was normal, with the exception of the brain, which was soft, vascular, and the ventricles contained several ounces of fluid. Here we have the state of the vascularity of the brain, its softness and want of absorbing power, and lastly, the accumulation of serum.

In some cases the pulse is never slow, and the pupil is only irregular, contracted in the absence or presence of light.

In the third stage these symptoms are followed by stertorous breathing, coma, partial convulsions, and death.

The diagnosis in the primary stage is difficult, as the symptoms resemble so much those of a disease of the abdominal viscera in children, as worms, remittent fever, &c. There is no pathognomonic symptoms, until the disease has proceeded so far as to render remedies of little use. On this account, unless the disease is detected and proper remedies had recourse to in an early stage of its course, our prognosis must always be very guarded. When the disease has proceeded so far as to produce paralysis, little hope can be held out of recovery.

The length of time a person may exist with this disease will depend upon the age, and the rapidity with which the serum is accumulated.

It may exist for years without any inconvenience, at other times it produces epilepsy, fatuity, &c.

Dissection.—The arachnoid membrane is found in different states in certain individuals and parts of the brain. At one place it appears pale and dry, at another there is an increased secretion from the part, which is opaque and thickened, and the pia mater engorged with blood. The ventricles are distended with serum, often of a straw colour, with a portion of the neighbouring brain softer and more watery than natural.

In some cases tubercles are found in the substance of the brain, the pineal gland, or the thalmus nervi optici is enlarged, &c.

In almost every case of hydrocephalus more or less serum is found collected in the vertebral column, from the affection of the arachnoid membrane, and from the gravitation of the serum from the ventricles of the brain.

In some persons, from an increased determination of blood to the head, or congestion in the brain, fatal coma is produced. This occurs suddenly in some. In these cases the only morbid change discovered in dissection is a collection of serum in the ventricles, with more or less appearance of congestion.

The vessels on the surface of the brain are turgid with blood, and many of the vessels of the pia mater contain globules of air ; while an effusion of a sero-gelatinous fluid forms between the pia mater and tunica arachnoides on one or both sides, in those cases in which death had been preceded by delirium.

Treatment.—So little can be done for persons with confirmed hydrocephalus internus, that some have disputed its cure in any case, and suppose that the cures on record were cases of other diseases mistaken for this.

When inflammatory symptoms are present, leeches, venesection, an emetic, cold lotions to the head, blisters, purgatives, injections, &c. are required. Mercury is of much use in discharging the bile, and increasing the powers of the absorbents. It should not however be exhibited until the other evacuant remedies have been employed. Sometimes sudorifics and the warm bath will be of service ; digitalis will also be found of use in some cases. Puncturing is rather to be considered as a palliative remedy.

The diet must be vegetable, with a little milk ; and if the pro-

gress of the disease be arrested, the strength is to be established by nutritious diet and tonic medicines.

Hydrorachitis.

The increased irritation of the arachnoid membrane may extend to that of the spine; and from the free communication between this and the ventricles of the brain, when the ossification of the spinal column is imperfectly formed, the membrane protrudes where it meets with least resistance, viz. at the imperfectly ossified parts, and forms the tumour called *spina bifida*.

This disease is generally congenital, and forms one or more tumours of different sizes and shapes, and more or less transparent, situated commonly in the lumbar region. When pressure is made upon these swellings, it often produces symptoms of compression upon the brain. In consequence of the pressure of these tumours upon the lower part of the spinal marrow, the bladder and rectum are often in a state of paralysis.

In some cases the skin is not completely formed over the tumour, which is covered with the dura and pia mater and arachnoid membrane. The lateral arches of the corresponding vertebræ are separated or wanting; and in consequence of this weakness the tumour sometimes bursts, and a small fistulous opening with a red border is left, from which a yellowish fluid flows. An infant which I saw with such a fistulous discharge was five days old; it died fifteen days after. During this time an attempt was used to close the small fistulous opening with an adhesive plaster. For some days the child continued well, but seemed to suffer when the plaster was removed, and the opening appeared of a red colour: the irritation increased; the inferior extremities became paralysed, and an abundant flow of serum took place from the opening for some time before his death.

The body was dissected twenty-nine hours after death.

The brain was vascular, and the veins gorged with blood. On opening the lateral ventricles, they were found filled with a considerable quantity of yellowish serum, exactly similar to that which had flowed from the wound during the life of the infant. A free communication existed between the lateral and third ventricles;

and between this by the aqueduct of Silvius with the fourth ventricle and spinal canal. The spine was next exposed, where a large oval-formed gap was found in the lumbar vertebræ, from a deficiency of the spinous processes, the yellow ligament and posterior part of the ring. On passing a probe from the opening in the tumour, it was found to pass under the dura mater. On dividing the tumour, it was found to be formed of condensed cellular tissue, and some of the same yellowish serum as that found in the ventricles flowed out, and appeared to be situated between the dura mater and arachnoid membrane, which was lined with a false membrane. The spinal cord looked red, and numerous large veins appeared on its surface.

The inflammation of the membranes of the spinal marrow seemed to have occurred after the opening in the tumour, and hastened the death of the infant. In this case there was an evident connexion between the ventricles of the brain and the spinal tumour, which probably formed at a very early period, when the increased secretion pressed upon the different parts of its surface, which yielded at the weakest part,—the unossified spinal column.

I assisted M. Magendie of Paris in dissecting another case of hydrorachitis, complicated with hydrocephalus. The tumour of the spine could not be distended when the body of the child was placed in different positions, but continued flaccid, with a thin central covering and prominent hard margin ; a considerable quantity of a sero-gelatinous fluid was found upon the hemispheres of the brain, the convolutions of which were unravelled ; a large quantity of serum was found in the lateral, and a free communication between the third and fourth ventricles and the spinal canal. On raising the posterior part of the hemispheres, a quantity of serum was found, and from its being contained within the arachnoid, this was very evident, but no communication was found between the ventricles through the foramen described by Buliot.

In another case the tumour was not opened during life, and on examination the arachnoid membrane appeared natural. Part of the spinal canal was wanting in the lumbar region in its posterior part. When the head was depressed the tumour became lax, and when raised it was distended. The serum in this case could be seen passing upwards and downwards under the dura mater by its

specific gravity. Some serum was found in the lateral ventricles. The tumour was carefully dissected, and was found to consist of the integuments, condensed cellular tissue round the margin, the dura mater and a lining of the arachnoid membrane.

I have been thus particular in the relation of these cases, from the fatality of the disease, and the variety of treatment proposed for its cure, in the belief that the first step to the rational treatment of a disease is a knowledge of its nature. From the above dissections, the disease appears to be caused by the weakness of the part which affords least resistance to serous enlargement; this forms a tumour, distension after birth being produced by the gravitation of the serum that irritates the serous or arachnoid membrane, and thus increases the inflammation. By the pressure which the accumulated fluid causes upon the lower part of the spinal marrow, we explain the occurrence of paralysis and the speedy death of the infant.

Sir Astley Cooper has related several interesting cases of this disease in the " Med. and Chirurg. Transactions," vol. ii. p. 324. In one case he treated it " as a hernia, by pressure ; and although this seemed to produce a convulsion, and the infant appeared in some degree dull if the truss was left off for a few minutes, and then reapplied," the child recovered. In another case he evacuated the swelling by a fine-pointed instrument. This was repeated several times, and pressure by means of a roller was applied. After several operations the fluid was found sanious ; afterwards the tumour inflamed, and the serum was mixed with coagulable lymph, and the child suffered considerable constitutional irritation ; after eleven evacuations a cure was accomplished. In a third case the adhesive inflammation produced after the punctures closed the cavity for the reception of the spinal fluid. The infant died, and about six ounces of a limpid fluid were found, with clots of coagulated matter floating in it.

The fourth case was cured by the same means.

The success of this treatment deserves the best attention of the profession, and proves that the palliative treatment, as recommended by Sir Astley Cooper, by means of a truss to prevent the descent of the fluid, is often successful. A still more powerful means of accomplishing this object, is the continual horizontal po-

sition of the patient, with the tumour raised as much as possible by lying upon the belly.

Instead of employing the dangerous means of obtaining the radical cure of this disease by exciting inflammation of the arachnoid membrane, and its generally fatal consequences, I should prefer the employment of sticking-plaster to prevent the contact of the air with the serous membrane, and to give support to the tumour, using gentle counter-irritants along the spine, so as to diminish irritation, and increase absorption.

In many cases, however, we must be regulated by the peculiar circumstances of each patient.

Dropsies of the Neck and Thorax.— Œdema of the Glottis.

When inflammation occurs in the glottis, or neighbouring parts, an accumulation of serum sometimes occurs, swelling the rima glottidis with a soft colourless fluid.   In other cases the inflammatory symptoms are more acute, and a sero-purulent infiltration is the consequence.

In such cases the voice becomes changed, and is sometimes entirely suppressed.   In some cases a soft tumour may be felt by the finger at the root of the rima glottidis.   The patient complains of a painful uneasiness, and great difficulty in respiration, which occurs in paroxysms, with sonorous inspirations, while expiration is performed with comparative ease.   These sudden and great changes in the breathing prove that much of the constriction in the air-passages depends upon spasm of the rima glottidis, produced by the irritability of the part.

The paroxysms increase in frequency and force, until the patient often suddenly dies in one of them.

In a case of this kind, the patient suddenly started up in his bed during the night, rushed along the ward, and fell down dead.

The cause and nature of the disease will modify the treatment to be employed, which will consist in leeches, cooling laxatives, purgatives, fomentations, blisters, with the exhibition of antimony and mercury.   In some cases powerful purgatives, and sometimes digitalis, are required to reduce the frequency of the pulse.

In the more chronic form, along with calomel internally, external applications must be made to the neck.

Œdema of the Lungs.

When an obstruction takes place in the circulation through the heart after pneumonia, chronic diseases, or towards the end of life, an œdema of the cellular tissue of the lungs often occurs.

In such cases respiration becomes difficult, with a slight râle crépitant, but without much respiratory murmur.

Hydrothorax.

The sudden exposure to cold when the body is heated often induces such a check to the perspiration, and degree of inflammation, as to produce a consolidation in the venous capillaries, the arterial branches of which then pour out modified secretions. The same effect is often produced after pleuritis, when the arterial branches are first free from consolidated blood, and pour out an increased quantity of serum. As the walls of the thorax prevent our feeling the increased accumulation of serum in the pleural sac, its presence is detected with more difficulty. In this case the symptoms indicating its presence are the general symptoms of dropsy ;—the difficulty of breathing, the paleness mixed with lividness of the face, the difficulty of lying in the recumbent position, the uncomfortable sleep, and frequent startings. The most certain proof of a collection of serum in the chest, is by hearing it moving about on shaking the individual, and by the stethoscopic signs.

This disease is frequently produced during the convalescence from scarlatina, measles, and the retrocession of chronic cutaneous diseases. In such cases the disease usually extends so as to affect the extremities, particularly the superior extremities, the face, and sometimes the brain.

In this form of dropsy, as well as in the cases produced by inflammation of the thoracic viscera, the kidneys are often chronically inflamed.

The important functions which the lungs and heart perform, explain the sudden appearance of dropsy over the body, when the

lungs, bronchiæ, or heart is inflamed. When the lungs are so affected, the dropsical effusion takes place in the cellular tissue of that organ, as well as in the sac of the pleura. A more chronic form of dropsy is produced by an obstruction to the circulation in the left side of the heart, or by organic diseases of the lungs, liver, or kidneys, by which the return of venous blood is impeded.

Hydropericarditis.

The general increase of serum in the different serous sacs and in the cellular tissue, more generally occurs to a considerable extent in a particular sac ; as the cause is usually not confined to one but extends to several, and is increased by sympathy. When hydropericarditis from a chronic local cause is produced, it is distinguished with difficulty from hydrothorax during life. It is upon careful attention to the history of the disease, and by the assistance of the stethoscope, that our diagnosis must be founded. The symptoms of the disease are an oppression and weight in the region of the heart, a difficulty in breathing, especially in a horizontal position, when it increases to a sense of suffocation, a small quick and irregular pulse, fainting, starting in sleep, anasarca with its symptoms of thirst, scanty urine, &c.

Ascites.

Ascites is often preceded by loss of appetite, lassitude, dryness of the skin, diminution of the alvine and urinary discharges, with oppression at the chest, and cough. The swelling increases slowly from below upwards, until the whole abdomen becomes uniformly swelled and tense. As the swelling enlarges the difficulty of breathing increases, and the countenance exhibits a pale and bloated appearance. The thirst increases, the skin feels dry, the pulse is sometimes quicker, at other times slower than is natural, the urine is very scanty, thick, and high-coloured, and deposits a lateritious sediment.

This form of dropsy may be in the peritoneum, or be abdominal, or it may consist of separated sacs contained in the serous membrane, or be sacculated.

Abdominal Ascites.

This form of dropsy is sometimes produced after exposure to cold, after intermittent fever, or diseases of the spleen, scarlatina, retrocession of cutaneous diseases, suppression of habitual discharges, or a certain degree of inflammation in the neighbouring parts. Towards the latter stage of dysentery, dropsy is a frequent and always a most dangerous symptom, as it indicates extensive inflammation in the part, with weakness of the system. In such cases it usually commences as ascites, and then extends to the feet and scrotum.

In some cases ascites is accompanied with frequent hard pulse, general symptoms of fever, and tenderness and pain in the abdomen. In general the increased secretion takes place from the chronic inflammation of the serous membranes, without any marked symptoms of inflammation.

Ascites is often produced by inflammation of the neighbouring organs, as the liver, spleen, &c. In the latter case the urine is albuminous, and of low specific gravity; there is little pain or fever. In this case it often appears suddenly.

In some cases it is produced by an asthenic state of the system, as in chlorotic females, and children, after hæmorrhages, &c., or any causes producing exhaustion.

In all such cases of ascites the swelling in the abdomen commences from below and extends upwards, with symptoms of fluctuation, difficulty of respiration, and permanent enlargement of the external veins upon the abdomen. The urine is scanty and high-coloured, there is thirst, &c.

In many cases, when there is a chronic disease in the liver, kidneys, &c., dropsy is produced on an attack of asthma, or accession of any disease in the chest retarding the circulation in veins previously weakened by the disease in the liver.

Ovarian Dropsy.

As the ovaries have no cavity, it must be supposed that this disease commences in one of the vesicles which these bodies contain, after

injuries in the iliac region, or the like. Women who have had many children, or been subject to uterine diseases, are liable to this disease, particularly on the cessation of the menses.

The swelling is usually preceded by pain in the iliac region; and sometimes an enlarged ovarium, in the form of a tumour, may be felt there.

The swelling in this disease increases slowly in size, and is at first confined to one side. In other cases the swelling increases rapidly, with symptoms of inflammation, from injuries or constitutional derangement.

When large, it produces pain, numbness, and cramps in the thighs; the appetite diminishes, the strength becomes impaired, and the body emaciated.

Ovarian dropsy may be distinguished from other complaints with which it may be confounded, by pain and swelling being generally first observed in the iliac region, by its increasing more on one side than on the other, and above than in the lower part of the abdomen; by the breathing being affected some hours after eating; by absence of œdema of the feet or other parts of the body, and of all dropsical excitement of the system, by the urine not being serous, the pulse being natural, &c.; but the pulse in the course of the disease becomes weaker, with the other functions of the body.

As ovarian dropsy is a local disease produced by an inflammatory cause, it is to be removed by local antiphlogistic remedies combined with diuretics.

TREATMENT OF ACUTE DROPSY.

This most common cause of dropsy requires the employment of antiphlogistic remedies for its removal. In many cases general bleeding must be had recourse to, and in some patients repeated. Should the cause be more local, and the disease less acute, topical evacuants will be sufficient, and may be repeated frequently. The blood in these cases has the buffy coat.

In some cases of local dropsy the application of a blister to the part will be of use. Diaphoretics may also be used with advantage, as they equalize the circulation and relieve the skin.

For a like reason, friction with oil will be of much use when the skin is parched.

After the febrile symptoms have disappeared by proper anti-phlogistic remedies, and in the subacute forms of dropsy, much advantage will be derived from the use of certain diuretics. Of these, digitalis is the most powerful. In the dropsy after scar-latina it approaches the properties of a specific; during its ac-tion, the quickness of the pulse, the effusion and the coagulable pro-perty of the urine disappear. This medicine would seem to act by diminishing the action of the heart and arteries, and thus weak-ening the secreting power of the vessels, and equalizing the cir-culation.

In such cases digitalis should be given in small quantities, and increased with caution. Stimulants may sometimes also be added to it for preventing its deleterious effects. But this medicine should not be given for a long period at a time, as it is liable to accumulate in the system, and produce great debility and languor. In other cases it may be given combined with other diuretics, with-out diminishing the action of either.

Infusion of juniper, the acetate of potass, balsam of copaiba, turpentine, and colchicum autumnale may be employed in this disease.

All these diuretics must be changed frequently.

Mercury increases absorption, removes obstruction or organic affections, more particularly enlargements of the liver, &c. When employed to a considerable extent, it produces great emaciation of the body with loss of strength, and by increasing the predisposition to dropsy, often developes a hitherto latent disease. To prevent such an effect, the mercury may be combined with squills, digitalis, sulphate of iron, &c.

The squills may be given by itself, taking care to give it in such small doses as not to produce nausea. The dose is to be slowly increased.

Another indication of cure is to increase the secretion from the skin and intestines.

After the necessary depletion has been performed, the dry skin of the dropsical patient is to be relieved, and his urgent thirst gra-tified by adding to the drinks diuretic remedies, such as the super-

tartrate of potass in small doses.   In other cases it may be given in large doses, as also Epsom salts in a large quantity of water.   This medicine loses its effect when long used, and should in such cases be left off for some time, or combined with a small proportion of other purgatives.

These and other remedies may be used in a large proportion of water, so as to assuage the thirst.   This seems rather to diminish than increase the disease; but this should be occasionally proved by measuring the injesta and comparing them with the urine.

Purgatives form another important class of remedies to be employed in dropsy, particularly the hydragoge cathartics combined with diuretics.   For this purpose calomel and jalap, or compound extract of colocynth in repeated doses, or five grains of calomel and five of gamboge, or five of gamboge with the same quantity of the aloetic pill, may be tried.   Scammony, but in particular elaterium, will be found most useful.   This medicine in the form of extract, given with five-grain doses of extract of gentian, may be repeated every hour until watery evacuations are produced.   It must not be used too long.   It may be repeated at intervals of two or three days for a fortnight.

Croton oil may be given with the same intention in minim doses.

Mineral waters will be found of great use after the exhibition of these strong purgatives.

It has been stated that the diet should be light and easily digested; but after proper depletion, or in cases of old disease, the system may be so debilitated that the dropsy is increased by this cause.   For preventing such a consequence, the diet must be rendered more generous ; and tonics, as bark and steel, will often in such cases be found of much use.   The habits of the patient should be as little interfered with as possible.

When the acute symptoms have been reduced, and it is found that the accumulation of serum is so great as to impede respiration and other important functions, and prevent the favourable action of medicine to reduce it, advantage will be derived from tapping or drawing off the morbid accumulation of fluid, in doing which the parts are to be supported by a proper bandage, and the contraction of the muscles and perspiration of the part are to be promoted by frictions with oil, &c.

VARIETIES OF DROPSY.

The varieties of the acute or inflammatory form of dropsy are either accidental, symptomatic, or specific.   I shall now add a few remarks on each of these varieties.

ORDER I.

ACCIDENTAL VARIETY OF DROPSY.

The remarks already made on this order of inflammations will only require me to describe an example of this variety of dropsy. Phlegmasia dolens may be taken as an example of this form of dropsy.

Phlegmasia Dolens.

This disease usually commences some days after parturition by a sudden attack of pain in the hypochondriac region and groin, with symptoms of inflammatory fever.   The groin inflames, and the swelling extends to the labia pudendi of the same side.   The pain and swelling in the groin extends along the inside of the thigh, which increases often to twice its natural size, and is very painful and sensitive.   Levret * says the tension and pain follow the course of the crural vessels, and Puzos † and Gardien ‡ say they have remarked a knotty cord, sometimes of a red colour, along the course of the crural vessels.   Enlarged veins become evident on different parts of the leg, but they disappear as the swelling increases, when the skin becomes colourless and shining.   These large veins are not always more tender than usual, in consequence of the phlebitis being chronic.

CASE I.—*Phthisis Pulmonalis, which terminated fatally two months after parturition, with inflammation of the principal abdominal veins.*—A young

* L'Art des Accouchemens.
† Mém. sur les Dépôts Lactueux, p. 250.
‡ Traité d'Accouchemens et des Maladies des Femmes, p. 137.

woman was admitted into the hospital of La Charité, Paris, on account of phthisical symptoms, which had rapidly increased in violence, and reduced her to a state of extreme emaciation after her confinement, which occurred about two months before.   Several weeks from the time of admission she died.

On dissection the arachnoid membrane was found more opaque than natural, and a considerable quantity of serum was found in the ventricles of the brain.   The lungs were extensively diseased, and the large intestines were ulcerated in several places.   The right leg was swelled by infiltration.   The uterus was larger than natural ; its inner surface was inflamed, and its substance very vascular.   The distended venous branches were numerous, and filled with liquid blood.   The venous trunks of the uterus were tortuous, and distended by consolidated blood, which likewise filled the lower part of the inferior vena cava, the common internal and external iliac, and the femoral veins of the right side.   This consolidated blood had a general striated appearance, and at several places was converted into a hard light-coloured substance, which was broken down into a pultaceous matter at several points.   In this case the veins seem to have inflamed after parturition, probably from the state of the uterus ; but from the weakness of the system, and the severity of the pulmonary disease, the inflammation remained in a chronic form.

CASE II.—*Inflammation of several of the abdominal veins, which occurred after parturition.*—In the spring of 1822 I examined the body of a young female, said to have died of puerperal fever, which was brought into the dissecting-room of the Royal College of Surgeons, Dublin.   The inferior extremities were swelled and œdematous.   When the abdomen was opened, the uterus was found double the natural size, unusually vascular, and its internal surface red and inflamed.   The internal and common iliac veins of the left side, with the vena cava abdominalis and left emulgent vein, were completely filled with consolidated blood, which adhered to the internal coat of the veins ; the tissue was thickened, and at several points broken down, and containing pus.

In one of the late volumes of the Medico-Chirurgical Transactions, Dr. D. Davis describes several examples of phlegmasia dolens, which have a considerable resemblance to the last two cases.

Since that excellent paper appeared, M. Velpeau has published several additional examples of the same disease.   It has been denied by some experienced practitioners that these were cases of phlegmasia dolens, as some of the most characteristic symptoms

of this peculiar disease, as described by White, Hey, Hamilton, Capuron, &c. were absent. But a careful consideration of the cases on record, with some opportunities of observing the disease myself, have led me to conclude that the two cases above-related, and also those by Dr. Davis and M. Velpeau, are the acute stage of the same disease, which has been usually described in its more chronic form. The following is an interesting example of the usual manner in which phlegmasia dolens commences.

CASE.—*Incipient symptoms of phlegmasia dolens ; fever ; cure.*—A young Armenian woman was delivered of her first child. She had a tedious labour, and recovered slowly. A fortnight after it she was attacked with fever, and complained much of pain in her left leg. I found the upper part of the thigh swelled, and having a cord-like feel, particularly along the course of the saphena major vein, which was tender.

Repeated bleedings, followed by fomentations, low diet, antimonials, and occasional purgatives, constituted the plan of treatment. The symptoms disappeared progressively, she got quite well, and the thigh soon regained its natural size.

Some weeks after I was again requested to see this woman, whom I found labouring under a second attack of the same disease ; but the symptoms yielded to a repetition of the same treatment.

This case presents the very simplest form of phlegmasia dolens checked in its course, when the most characteristic symptoms were absent.* And there can be little doubt, from the dissections already described, that if the disease had been allowed to advance, the swelling would have extended down the thigh to the leg and foot.

The chronic form of phlegmasia dolens, as it has been usually described by authors, is explained by the inflammation in the veins of the part, which advances slowly, as the system is usually weak, and there is a determination of blood to the breasts.

In proportion as the iliac veins are filled with condensed blood, the circulation in the venous branches becomes more languid, the frequent inosculations of the smaller branches are obstructed, while the arteries, which are under the powerful influence of the heart,

* Capuron, Traité des Maladies des Femmes, p. 552, &c.

R

are not affected; they secrete, but the veins and lymphatics do not absorb in the same proportion, and a swelling is the consequence, more particularly round the vessels affected, and in the cellular tissue of the parts from which they arise. Their anastomosing branches enlarge, and as the condensation in the vessels and fever augment, they again disappear in the distended cellular tissue, which forms a colourless shining swelling. This swelling appears only to differ from anasarca in being more resistent to pressure, by being little affected by situation, and by the effusion being solid.

The fever continues for two or three weeks, while the swelling and pain diminish after the first two or three days, first in the groin, and then extending downwards. Generally a swelling remains permanent, and often of a large size, upon which indolent and most intractable ulcers form. Other parts of the body may be similarly affected.

The chronic form of phlegmasia dolens commences from the tenth to the fifteenth day after delivery, with a feeling of tightness, pain, and a slight tinge of inflammation in the groin, over the course of the vessels, and slight feverish symptoms. The swelling of the thigh, labium pudendi, hip, and hypogastric region of the same side increases, and is hard and incompressible, from whence it extends down the thigh to the leg and foot. At first the swelling follows the course of the inflamed venous trunks, but afterwards it extends to the whole circumference of the leg; varicose veins in the course of this swelling appear, branching out on different parts of the leg; but as the disease advances, they become less evident, and the skin becomes colourless and shining.

Various explanations have been given of the nature of this disease. White * supposed that the symptoms were produced by a laceration of the lymphatics during pregnancy, followed by their obliteration. Hull † considers it to be an inflammation of the lymphatic vessels, which produce an effusion of lymph into the cellular tissue in one of the inferior extremities. M. Alard considers the frequency of the disease to depend on the predisposition to inflammation which the process of parturition produces on the

*

* Observations on the Swellings of the Inferior Extremities after Childbirth.
† Essay on Phlegmasia Dolens.

lymphatic vessels, when lymph is accumulated in the leg, producing the symptoms of the disease. The opinion of Dr. Ferrier, * Dr. Fry, &c. that the disease is produced by an inflammation of the lymphatics of the leg, seems probably to have arisen from cases of phlegmasia dolens being accompanied with an inflammation of these vessels, indicated by a red streak along their course, and by the swelling of their glands. This occurrence affords but an unsatisfactory explanation of the symptoms; and the reason of the lymphatics being affected secondarily is explained by the discoveries of Fohman and Louth, who have proved the connexion between these vessels and the veins ; on which account the lymphatics must participate more or less in all cases in which the veins are extensively diseased. Several cases related in this treatise prove the truth of this explanation. In several cases of puerperal fever related by Dr. Clark, the veins in the pelvis contained pus.†

Dr. Davis believed that the disease was produced by phlebitis, Velpeau by phlebitis and inflammation of the ligaments, Mr. Guthrie and Dr. Lee by inflammation of the uterus, although injury to the joints of the pelvis may likewise act as an exciting cause.

For these reasons it appears that phlegmasia dolens is produced by the sudden changes to which the vessels that return the blood from the internal organs of generation are liable after parturition, when the circulation in the veins is left languid, and they are predisposed to disease, which is often excited by the injury that these vessels and the pelvic viscera sustain during parturition, such as injury of the pelvic joints, and inflammation and morbid secretions from the uterus. Such exciting causes are often increased by imprudence in diet, exposure to cold, &c.

A frequent cause of this disease some days after parturition is metritis, which extends to the predisposed veins, and from these to the great trunks, so as to involve the external as well as the internal iliac vein, the common iliac, and even the vena cava abdominalis. It is in consequence of the early affection of the internal iliac, which is so deeply situated that its state cannot be known, that this disease is so insidious; but as soon as the external iliac and

---

* Med. and Phys. Journal, vol. 56, p. 34.

† See Trans. of a Society for the Improvement of Medical and Surgical Knowledge, vol. 1, p. 19.

its branches are involved, the consequence of the obstruction and debilitated absorption is a swelling of the parts from which its branches arise ; this first becomes evident near the groin ; the lower extremity swells as the veins become more extensively affected.   It is for a like reason that we explain why the swelling is confined to one side of the mesial plain, from vessels being distributed upon the side they arise from.   So exactly is the swelling bounded by the mesial line, that White says the swelling never passes the straight line drawn between the umbilicus and anus. But when the disease is more violent it may envelop both sides of the body.

The chronic form of phlegmasia dolens, as it has been usually described by authors, is explained by the inflammation in the veins of the part advancing slowly, as the system is usually weak ; and there is a determination of blood to the breasts.

The explanation of the cause and progress of the disease appears sufficiently distinct, when the veins are considered as the parts principally affected ; for, in proportion as the iliac veins are filled with condensed blood, the circulation in the venous branches of the part becomes more languid, the frequent inosculation in the venous branches becomes engorged, and the circulation impeded, while the arteries, which are under the powerful influence of the heart, are not affected.   These extreme vessels secrete, and from their increased irritability when the veins are inflamed, the secretion is increased in quantity, and contains more coagulable lymph than usual.   This produces a swelling, which is increased by the lymphatics and the veins being engorged and obstructed, and not absorbing in the same proportion.   As the secretions are thus accumulated, they produce the rapid and large size of the swelling in the part from whence the diseased veins arise.   The anastomosing branches of veins enlarge, and appear like varicose veins ; but as the inflammation and consequent consolidation of blood in the veins become more general, the fever increases, and the absorbents become inactive, which augments the swelling in the superficial cellular tissue, by which the enlarged veins can no longer be seen, and it becomes glossy, hard, warm, tense, elastic, painful, and of a white colour.

These remarks will explain why this swelling may occur in other

parts of the body besides the inferior extremities, and in the male as well as the female ; although it is more frequent in the lower extremities of the female, from her being so much more liable to the exciting causes.

The indications to be remarked in the cure of phlegmasia dolens may be stated as follows :—

1. To remove the local inflammation ;
2. To increase the action of the veins and lymphatics ; and
3. To palliate troublesome symptoms.

Order II.

ELEPHANTIASIS.

The following remarks on elephantiasis assume it as affording an example of the symptomatic form of dropsy.

The importance of observing the first invasion of a disease is in no case more marked than in the different descriptions given of elephantiasis by different authors. This is in a great measure owing to the progress of the disease being at first slow, and only obtaining attention when it has continued a considerable time, and produced effects which induce the person to apply for assistance. At this time the swelling and morbid change in the structure of the part are often so very great, as to render the nature of the periodic attacks of the disease obscure. On this account the effect has almost invariably been confounded with the cause, which has led to different and I believe erroneous opinions as to its nature. By observing the first invasion of the disease, I believe more just pathological opinions will be arrived at, which will necessarily lead to a more just and satisfactory treatment.

Possessing opportunities of noticing such cases, I requested an intelligent native assistant to note down the symptoms as they occurred in the following examples of the disease in its primary form, and I had an opportunity of judging of the accuracy of his remarks. I have only altered the language of these notes.

Case I.—Takoor Doss, aged 19 years, states that three months ago he was attacked with elephantiasis. At first he felt a tension like that of a

string along the thigh, with severe pain and fever, which diminished, and two days after, a swelling appeared in the leg and foot, with a feeling of tightness, and very slight pain.   By the application of several warm and stimulating native plasters, the swelling disappeared.   A month after, at the time of the full moon, it re-appeared with the same symptoms as above described.   He is now suffering from a fourth paroxysm of the disease.

The next case is a more acute form of the same disease in a young and strong individual.

Case II.—Issurchunder, aged 15.   In this case the disease commenced with redness and pain of the whole thigh, accompanied with fever.   It continued four or five days, followed by a swelling below the knee-joint, which extended over the whole leg and foot, with pain.   For the last ten days it has continued in the same state.

Case III.—Khaturmohun, aged 22, was first attacked with the disease a year and a half since.   It commenced with a hardness, like that of a string, along the thigh, accompanied with severe pain and fever.   The acute symptoms ceased after a few days' continuance, followed by a swelling in the leg and foot, with slight pain.   By the use of native applications the swelling nearly disappeared, leaving only a slight puffiness in the ankle-joint.   The man continued well for a month, but had again a paroxysm of the same nature at the full moon.   For seven or eight months he had similar attacks, sometimes at intervals of two months for the last eight or nine months, during which time the intervals of the paroxysms were longer; but the swelling continues to increase, and is more permanent, while the fever is more variable and less severe in its attacks.

I noted the following more common form of the first stage of this disease, but had not an opportunity of following its progress.

Case IV.—Bolonauth Das, aged 36, states, that six months ago he had an attack of painful swelling along the course of the saphena major vein of the left leg, which remained two months, during which time he had five or six paroxysms of pain, with swelling of the ankle-joint each time.   Four months ago the same swelling and pain in the course of the veins of the left hand and fore-arm occurred, with puffiness of the fore-arm.   There is now no swelling of the fore-arm; after continuing three months the swelling left that arm, and passed to the right, which for six days has been swollen and painful.   The humeral, cephalic, and basilic veins are hard like cords,

and more sensible than natural; there is a considerable swelling of the fore-arm, which pits on pressure being made upon it; pulse natural; tongue brown in the middle; bowels open. Aperients, with discutient oils, frictions, and pressure, were used with advantage in this case.

CASE V.—*Sept.* 1838. Gasee Bearer, aged 22, has been complaining for four days of a pain along the course of the great saphena vein, which increased yesterday, with fever that prevented him from sleeping.

18*th.*—Examined the leg, and found for four inches along the course of the vein, immediately above the knee-joint, a hard, red, painful, and very sensible swelling, with fever and constipated bowels. Leeches, purgatives, and antimony were ordered.

23*rd.*—The pain, swelling, and fever have increased, although he has had twice the application of leeches, with purges; poultices are now ordered, as the swelling appears to be passing to the suppurative stage. There is no swelling in the groin, and neither the foot nor leg swelled.

This patient, as is frequently the case, got better, and did not return. In many such cases I only saw them when forced to ask for relief during a severe paroxysm of fever.

CASE VI.—Torab Kitmutgar, aged 26, was attacked last night with heat of body, great restlessness, and pain in the left leg extending from the inguinal region down the inner side of the leg to the toe, which prevented him sleeping. I examined him next day, after he had taken a dose of medicine which had affected him four times. His skin was hot and perspiring; pulse 95; tongue brown. The leg is hot, and particularly sensitive along the course of the veins and neighbourhood, which are prominent from the thigh to the great toe. These swell on walking, which is performed with great difficulty, and is accompanied with pain. The inguinal glands are slightly enlarged, and very tender. There is no swelling of the leg or foot. It is the first attack he has experienced.

22*nd.*—Great perspiration, and feverish uneasiness and pain in the leg, which prevents him walking. The swelling along the vessels is harder and more prominent, and the leg is swelled under the knee-joint.

23*rd.*—Swelling of the leg and hardness of vessels disappeared; skin cool, and he feels much better.

In this case the paroxysm has disappeared, but it will again revive on exposure to cold, drunkenness, or imprudences in diet, more especially near the full or new moon.

The nature of this disease, it being a symptomatic affection of the veins, explains to us why it may occur in other parts of the body besides the lower extremities, although these are more liable to it from their free, depending and exposed position, from their distance from the heart, and from the quantity of cellular tissue they contain.

An attack of elephantiasis is usually preceded by shivering, anxiety, a feeling of listlessness, lowness of spirits, thirst, deranged bowels, and want of appetite. This is followed by a sudden feeling of pain in the groin, extending along the anterior and inside of the thigh, when the leg is the part affected. In other cases the pain is confined to the foot and leg, which are hot, swelled, and sensible. This local irritation is quickly succeeded by a rigor, and pain in the head, back, and loins, which is followed by sickness, sometimes vomiting, and great languor, lassitude, and prostration of strength. The pulse becomes hard and frequent, the skin hot and dry, and the patient complains of a burning sensation over the body, with great pain in the leg and foot affected, and often in the head. This hot stage is succeeded by local and general perspirations, with a feeling of relief to all the distressing symptoms. This febrile attack continues for two or three days, during which it usually increases for twelve hours, and after remaining a day or two in that state, slowly diminishes. During the attack imperfect morning remissions and afternoon exacerbations may be observed, which vary in degree from a well-marked state of fever to one that is scarcely observable. In general, during the continuance of the attack, the patient lies in bed, complains of great languor and feverish uneasiness, is distressed by speaking and noise of all kinds, breathes with an effort, and complains of pain in the head and leg. The tongue is covered with a thick white or yellowish coating; he has no appetite, and is prevented taking food, as the natives suppose that it will increase the disease; and for a like reason he is very rarely allowed to gratify his thirst. During the paroxysm any movement is accompanied with pain in the part affected, which often prevents the patient walking for days after the fever has disappeared.

When the groin and thigh are examined in the acute stage, a swelling may be discovered which extends to the knee-joint, or even

to the foot, following in this course the venous branches, and indicated by the pain and sensibility of the part on pressure; the neighbouring cellular tissue of the thigh and leg is swelled, and over it a net-work of veins frequently appears, having in some places a hard, round, cord-like feel, with a slight erysipelatous blush of inflammation along the course of the veins thus affected. The state of these vessels is best observed in the acute primary attacks of the disease. In one case I found, after a paroxysm, the trunk of the saphena major vein prominent on the bent knee-joint, with a hard cord-like feel, and a swelling upon the anterior part of the leg, from which many branches of the vein affected during the paroxysm had arisen. In other cases the local inflammation is confined to the foot and leg, which become swelled, hot, and pit on pressure being made upon them, while the lymphatic vessels and glands of the thigh and groin continue without any apparent change.

" These prominent veins in the neighbourhood of the inflamed parts during the attack are found," says Dr. Towne, " much distended with varicose swellings, which are very apparent from the knee down to the extremity of the toes." * As the disease advances, the local inflammation diminishes, and the distended veins disappear in the increased swelling of the part.

The degree and extent of this local inflammation vary in different cases, and depend on the constitution of the individual, the stage of the disease, and the severity of its exciting causes. The degree of the swelling varies likewise in different cases, and is first observed along the course of the inflamed veins, and the parts from which they arise, especially in most depending parts, where the cellular tissue is in largest quantities; and it varies in its nature according to the severity of the inflammation, and the frequency of the previous attacks. As the local inflammation diminishes, the swelling enlarges, and generally pits on pressure being made upon it, but becomes harder and more or less incompressible, and generally of a smooth red colour. It has then an uniform figure, and the skin appears distended, especially when there is much lax cellular tissue, as on the dorsum of the foot and about

* Diseases of the West Indies, ed. 1726, p. 185.

the ankles.   After several days' duration, the cuticle desquamates, and the person feels comparatively well.

The first attack leaves generally no permanent swelling, but disappears when the paroxysm has passed. The person is again attacked at uncertain periods with the same local and constitutional symptoms, and after several paroxysms a swelling is left, which is augmented by each attack, and diminishes during the intervals. This diminution becomes less marked after the disease has continued a considerable time, as in this case the veins of the part become more extensively diseased, but from the swelling it is often impossible to detect their state; and even when we have an opportunity of dissecting parts which have become deformed by the slow depositions after each accession of the inflammation, it is difficult to determine what state the vessels are in during the paroxysm.

Sometimes the distended skin bursts or ulcerates in a severe attack, and a discharge of a serous fluid takes place with great relief to the patient. This fluid, as its temperature diminishes, sometimes coagulates into a white mass. In other cases these acute local symptoms terminate in abscesses in the leg or foot, the discharge from which mitigates the symptoms.

These attacks of fever and inflammation may occur frequently, or at considerable intervals. In general, however, after exposure to the exciting causes, of which cold and moisture are the principal, these attacks occur more frequently; the moon, too, may be observed to have a remarkable influence in producing the paroxysm. In many cases it takes place at the change of the moon, in others at the full, and in some, more especially at the commencement of the disease, at both change and full moon; and in the young and plethoric subject, even at shorter intervals.

The disease is more rapid in its course in young and strong than in old and weak persons; and as the swelling of the leg increases, the regularity of the paroxysms and severity of the inflammatory symptoms diminish; from the twelfth to the twentieth year they no longer recur with their previous severity or regularity. In this last stage of the disease, the person seems in good health, the functions of the body retain their natural vigour, and the patient feels no other inconvenience but that of dragging about an enormous mass.

In plethoric individuals the disease continues with little intermission in a state of excitement, and the deformed skin is exquisitely sensible. In both Mr. Chevalier's cases, the individuals could not walk for years on account of the size and irritable state of the limb. " One of them was utterly unable to bear being lifted up into the erect posture, and could only be gently raised from her seat with exquisite pain ; mortification at length put a period to her misery." *

In the more chronic form of the disease, as seen in India, individuals may be often seen performing in the usual manner all the duties of servitude until the approach of another paroxysm ; but the feeling of weakness or very uneasy listlessness, deranged bowels, and want of appetite, which usher in the attack, generally continue after the paroxysm has terminated, and the functions of the deformed part are impeded by the increased swelling. In old cases the local exacerbations recur without any perceptible disturbance of the system.

Consequences.—When the part is examined after numerous paroxysms, it is found much enlarged, and has a hard, equable, shining and desquamating surface, which pits sometimes on hard pressure being applied. The leg and upper part of the foot are the parts principally swelled, and very large deep fissures are often found on the anterior part of the leg, from the movements of the ankle-joint and the strong fascia covering that part. In other patients, in particular when the disease has been long present, the skin becomes swelled in large tumours, or folds, which in some cases hang over others of a smaller size. This appearance is explained by the vessels which are principally affected arising from these parts, and by the quantity of cellular tissue which is bounded by the unyielding nature of the fascia, or continual movements of neighbouring joints, which prevent the enlargement of these parts. In some cases I have found these tumours of the natural colour, and as large as a child's head ; sometimes they are in clusters at the lower part of the leg. In other cases numerous tumours of different sizes are found on the upper part of the foot and lower anterior part of the leg, from a very minute to a large size, when they have

* Medico-Chirurg. Trans. vol. 2, p. 69.

often a pale colour, approaching to white, with varicose veins ramified along the surface of the larger tumours.   These tubercles or tumours are distinguished from the tubercles of lepra tuberculosa from being in the one case round and pendulous, and generally connected by a neck to the leg, while the latter are flat, irregular, and large at their connecting base.

The skin often continues of the natural colour and structure for years after the first attack, when it becomes of a darker colour, feels dry, with frequent desquamations of the cuticle, particularly after acute attacks.   The structure of the cutaneous tissue is thickened, the cuticle having generally a chapped and scaly appearance; in the native the skin becomes almost insensible, and in some places it takes on the dark horny appearance of ichthyosis. These changes seem first to be owing to an extension and thickening of the cuticle, which leave it in a morbid state ; the epidermis is very thick, and adheres intimately to the corion.   Below the epidermis Mr. Chevalier * found the papillæ of the skin excessively enlarged, elongated, and prominent at the surface of the dermis.

Fissures between the large swelling in the foot and lower part of the leg often discharge a thin transparent-looking fluid, which frequently becomes like jelly on exposure to the air ; in other cases this discharge takes place near the toes, from the abraded or ulcerated surfaces or heads of some of the tubercles, particularly during the exacerbations, which are relieved by the discharge.   These ulcers are superficial, and sometimes of a large size, with a hard edge and indolent surface, and are cured with great difficulty.

In some old cases, the appendages of the skin or toes become gangrenous and fall off; and in the more acute forms, which occur in Europeans, the disease often terminates in mortification of a part of the diseased member.

Elephantiasis commences in the same manner in the lax depending scrotum as in the leg.   The periodical attacks of local inflammation and fever commence with pain and a cord-like feel along the course of the veins arising from the scrotum, which have generally a blush along their course, as they extend over the part affected, feel sore, are sensible to the touch, and numerous enlarged

* Medico-Chirurg. Trans. vol. 11, p. 63.

veins are seen ramified on their surface. The part enlarges during the acute stage, and as the local inflammation diminishes, the swelling feels soft, so as to pit upon pressure from the unusual quantity of serum in the cellular tissue and serous sacs of the affected side, while the other side remains in its natural state. The testicle of the side affected participates little in the disease until the cellular tissue becomes so generally swelled as to affect the neighbouring parts, when one or both sometimes become enlarged, and in this aggravated form the cellular tissue on the opposite side of the raphè may participate. The cellular tissue of the penis generally swells as the disease advances, and becomes of an unnatural size, or often disappears in the large surrounding swelling, leaving only the extremity of the urethra visible. Over these swelled parts numerous varicose veins are seen extending towards the groin.

In a case which I examined in its first stage during a paroxysm, I found the whole scrotum enlarged, with a blush of red in patches on its surface, more especially along the course of the veins, which conveyed a hard cord-like feeling under the skin, when the finger was passed over the part.

The swelling of the scrotum, which at first is soft, and pits upon pressure, afterwards becomes hard, elastic, insensible, and of a dark colour. In many of these swellings the subcutaneous follicles and roots of the hairs appear much less developed, forming depressions, around which the laxer parts of the skin are left prominent and soft, from the cellular tissue being loaded with a thick glutinous-looking substance, mixed with serous fluid.

The symptoms of the disease in females, when one or both sides of the labia majora are affected, resemble so much those of the disease occurring in the scrotum in the male, that it is unnecessary to repeat the description of the affection; there is only slight difference arising from difference in structure.

The mamma, the neck, the upper extremities, and the face are sometimes affected in the same manner.

These local symptoms continue for two or three days, recur periodically, and are accompanied with feverish symptoms, as described under the disease as it attacks the leg.

Other parts of the body are sometimes affected with great enlargements of the cellular tissue, which appear to be of the same

nature, and increase in the same gradual manner as elephantiasis of the leg. Hillary has known " the morbid matter fall into an arm each time it came, and he once saw a patient in whom the morbid matter was cast upon the scalp, the ears, and the back of the neck; and another wherein the matter was cast upon the lower part of the spina dorsi, the os coccygis, and the loins, at each return of the fever."* This is a rare form of the disease in India. In an example of this kind I found the left leg and arm swelled to double their size in a middle-aged strong man, after repeated attacks of the disease.

CASE.—Ram, aged 25, states, that for four years he has laboured under elephantiasis of his left leg, which commenced with a paroxysm of fever, followed by a swelling of the part, and an appearance of " a small tendinous body along the whole length of the extremity." The swelling has since then increased slowly, without any severe paroxysm of fever. About two weeks since the same kind of swelling appeared in the right fore-arm, commencing with a peculiar sense of tension and pain in the axilla, succeeded by the " same appearance of a tendinous body " along the whole extent of the arm and fore-arm, which still remain of a diminishing size. There has been no accession of such fever as accompanied the first paroxysm in the leg.

Persons affected with elephantiasis often live long, and prove that the immense size of the affected part does not affect the duration of life, or general health; and the only suffering the person has is from the periodical attacks of inflammation and fever.

The remote causes of elephantiasis are all such as debilitate and derange the general system, and tend to produce irregularities in the circulation. The influence of the hot, low, and damp climate of Bengal, and the unhealthy food and bad water used by the natives, act powerfully in impairing health, and thus predisposing to attacks of this disease; the frequency of which is explained by the lax state and important offices of the skin in tropical climates, the debilitated state of the body of the Hindoo, especially when increased by losses of blood, &c. (Hillary), previous and long-continued disease, and the slowness of the circulation, which predis-

* Loc. cit. p. 313.

poses the veins to inflammation, more particularly those which return the blood from the more depending parts of the body, as of the legs, scrotum, &c.

So predisposed, the Hindoos are very frequently exposed to great vicissitudes of temperature, more especially towards the end of the rains and during the cold months, which act as exciting causes. During the rainy season the nights are frequently calm and moist, and feel excessively sultry, so as to induce the natives to leave their houses, which have seldom any aperture but the door to allow the entrance of fresh air, to sleep upon the damp ground or in an open verandah. Then a single thin cotton cloth forms their only defence from the emanations from the ground and cold unhealthy night dew. At these seasons of the year the wind often changes suddenly, and is accompanied with rain, which sometimes in a short time depresses the thermometer twenty degrees, and blows over persons so exposed, with the skin relaxed, and covered with perspiration. In other cases the fatigued and heated body of the Hindoo is chilled by bathing, and retaining the wet cotton covering on his loins in returning to his home, often at considerable distances, which produces a rapid evaporation, and consequently a considerable degree of cold. In other cases the disease would appear to be produced by having the feet long immersed in water when the body is exposed to the great heat of the sun, as in preparing the rice-fields, transplanting the rice-plant, working in wet mud for building houses, &c.

The influence of climate in producing elephantiasis is strikingly marked in Bengal; it is rarely however seen among Europeans until after a long residence in the country. The descendants of Portuguese are frequently subject to elephantiasis; and among their lower orders it is very frequently seen in the most aggravated forms. Females are peculiarly liable to the disease. I have lately been consulted by three females of European extraction with this disease, which occurred in paroxysms, in the same manner as among the natives. In another case I attended a boy, the son of an European by a half-caste mother, who had had five previous severe paroxysms of elephantiasis. In the attack I saw him labouring under, the right foot and leg were considerably swollen, and had a red erysipelatous blush on their surface. The permanent swelling

yielded to a course of medicine, assisted by frictions, bandages, &c. and for a number of months the attacks were kept off by attention to his bodily health, and avoiding the local exposure of the affected part.

We may therefore conclude that elephantiasis may occur in every clime, although it is more frequently found amongst those who inhabit low, damp, unhealthy situations in tropica climates, which impair the health, and thus predispose to the attacks of this disease. As the poor are most exposed to these causes, it is more frequently seen among them, and generally occurs after exposure to atmospheric vicissitudes, when the system is weakened by fatigue, unhealthy diet, &c.; and from want of care it assumes in them the most aggravated forms, especially in old age, when the venous is so much more developed than the arterial system of vessels.

The history of elephantiasis affords convincing proofs of this fact. The Arabian physicians explain the disease by the black unhealthy blood falling down upon the part, and divide it into two forms: Duwauli, which consists in a prominent and hard state of the veins of the leg and foot, from the excess of blood, of the nature of atrabile or glutinous phlegm, falling down upon them; from its gross nature it does not extend to the smaller branches, and is not poured out. This is the acute form treated by bleeding, &c. The second form differs from the last in the matter being no longer contained in the vessels, but poured out and imbibed by the flesh, as food is prepared in the stomach. It is consequently a much larger and more diffused swelling than the last form. The symptoms are, warmth of the skin, from the strength and heat of the falling matter, and blue colour of the part, which sometimes terminates in boils; from the swelling and hardness there is a loss of feeling in the part. Such opinions, the result of the humoral pathology, are now properly rejected by European authors of the present day, but the early writers generally confounded the disease with others. Thus Sauvages, Vogel, Sagar, and Cullen call the tuberculated leprosy, elephantiasis; and Vogel calls the large leg, elephantiæ Arabum, which he defines, " Eadem duntaxat in pede valde tumido et duro." More modern and better-informed authors, such as Towne, Hillary, &c. explained the formation of

this monstrous leg by the morbid matter of the fever, which by an erroneous application of a law of gravitation, was supposed to be gradually deposited in the leg, during an imperfect crisis of each paroxysm of the peculiar fever.

I have endeavoured to avail myself of opportunities of examining elephantiasis in its different stages, but especially in its primary invasion, and am confirmed in my opinion that it is produced by an inflammation of veins.* When so affected, a consolidation of blood takes place in the trunks, which extends to the smaller branches, and impedes the circulation in the part. The increased action of the arteries sends more blood to the part, increases secretion, and enlarges the anastomosing branches and capillary veins; this produces the red blush; and as the capillary arteries participate in the obstruction, the fluid they secrete into the cellular tissue of the part is increased, which swells it at the most depending position, especially when there is much cellular tissue, in the parts whence the obstructed veins arise. This impeded circulation weakens absorption, as may be observed by the swelling along the course of the superficial veins obstructed, and in the neighbouring cellular tissue.

The nature of the secretion varies with the state of the patient's constitution, the degree of inflammation, and the extent of the veins inflamed. When acute, the action of the neighbouring arteries is much increased; in this state the blood of the part contains more crassamentum, the secretion quickly consolidates, and the swelling is hard, as in the severe local inflammation producing phlegmon. In some cases of elephantiasis the local inflammation is so severe as to terminate in partial suppuration. For a like reason lymph discharged from a recently blistered surface is at first coagulated by exposure to the air; after some time, by the diminution of the inflammation, it is only coagulable by the application of heat; and at last the discharge is entirely watery, as the effect of the irritation diminishes. † When the blood is examined in such an inflamed part, it is found to contain more crassamentum, and the secretions more of the coagulating principle, which Blackall pointed out as

* See Essay on Phlebitis.
† Hewson's Enquiry regarding Lymph, p. 120.

s

an important criterion of the propriety of bleeding in dropsy. The second cause which modifies the nature of the swelling, is the extent of the disease. Should the principal superficial veins of an extremity be extensively inflamed, as is often the case in elephantiasis, and the habit of body weak, the size of the swelling will be considerable, and of a soft feel, so as to pit on pressure; this is from the effusion being of serum, which is displaced by pressure, but resumes its place in those cells of the tissue from which it had been pressed out.

When the effusion is so great as to burst the skin in the acute stage of elephantiasis, the lymph generally coagulates. As the acute symptoms disappear, the arterial action is diminished, and the absorbents become more active, and remove the more liquid part of the swelling, but they are left in too weak a state to remove that which the arteries deposited during their excited state, and so the part is left enlarged and hard. By the repetition of inflammatory attacks, more serum and coagulated lymph are effused into the cellular tissue, so as permanently to thicken the reticular covering of the part, and the member thus enlarges by slow degrees into the hideous deformity named elephantiasis.

This phlebitis, from predisposition and position of the veins, is much less dangerous, than when the veins are inflamed from a wound or an acute cause in a bad habit of body, and in a vessel near the heart. In more severe cases some of the tissues of the veins are thickened, and branches are obliterated, and the absorbents are weakened, so that the part is predisposed to other attacks of inflammation, especially on exposure to the exciting causes. The veins most commonly affected are the saphenæ, and other veins of the legs, as also those of the pudenda and of the scrotum, on account of their exposed situation and course. From these inflammation frequently extends to other trunks of the limb, by which the circulation of the extremity is impeded, producing the peculiar and aggravated symptoms of the disease. In some individuals the inflammation affects the veins arising from the scrotum or the labia pudendi, which explains the peculiar affection of these parts.

After each paroxysm of elephantiasis the veins of the part become more deeply affected, the circulation is left languid, and the

part is subject to relapses, until the disproportion between the functions of the secreting and absorbing vessels is such, that the local attacks of inflammation become weaker and the intervals longer. The swelling, however, remains defined by the extent of the veins affected, so that the swelling in the scrotum is often found of a great size on one side, while the other, which is accurately defined by the raphè, remains of the natural size, as the veins of either side terminate in trunks on the side of the body on which they arise.

The veins are sometimes inflamed in other parts of the body, from their exposure to the predisposing and exciting causes; on this account the epigastric region is sometimes the seat of the disease, which extends in some cases to the thorax, while in others the arm or head is affected.

The skin being supplied by the affected vessels, explains why there is redness succeeded by desquamation of the cuticle, and why the skin and neighbouring parts become slowly hardened and tuberculated, and terminate in an appearance like ichthyosis. The feverish symptoms are produced in this disease by the influence of an acute local disease, which acts on the already predisposed system, by the derangement of the circulation, and quantity of blood sent to the internal organs during the local disease, which explains the shivering, and, by sympathy with the stomach, the sickness and vomiting. When the reaction of the system takes place, it produces the hot and sweating stages, which are accompanied with thirst, from the copious secretion into the cellular tissue, and free cuticular discharge.

CASE.—Guarum Goss, aged 40, was attacked three years ago with swel-ling in the groin, which extended downwards and inwards, along the course of the vessels. This tract was sensible and red, followed by swelling and pain in the leg, above the ankles and over the footstep. After two days the testicle, or rather scrotum, was affected with pain and swelling. When this has ceased, fever begins with severe shivering, and the patient remains in a state of listless uneasiness, approaching coma, for three days. On the occurrence of a paroxysm of fever there is a bad taste in the mouth, everything tastes unnatural, and even water produces vomiting. The dejections are constipated, pulse frequent and strong, and the body hot.

There is much difficulty in seeing the progress of such attacks; if persons are kept in hospital for this purpose, the regular and spare diet prevents their recurrence. Should you propose visiting them in their own houses, this is resisted from prejudice, and from the desire of remaining at rest, as they suppose it a necessary evil which cannot be prevented; or which, if checked, will produce most dangerous consequences; and from the want of confidence in medicine, curiosity is alone considered the cause of our desire to examine the disease, and then there is great fear of interference that may be accompanied with pain or danger.

The man Goss was admitted into hospital with dysentery, of which he recovered in a few days; but although he was kept in the hospital after this time for more than a month, he had no return of the complaint, from the weakened state of the system, and regular and spare diet he used.

From the above facts I conclude, that elephantiasis is a form of symptomatic inflammation which commences in the veins, and in some cases may, from their anatomical connexion, affect the lymphatic vessels and glands. Like the other examples of this form of inflammation, its attacks commence with derangement of the stomach, followed by a local inflammation of veins in parts more particularly subject to such attacks, from whence it rapidly extends to the subcutaneous cellular tissue, producing, after repeated attacks, extensive and hard swellings of these parts. The state of weakness in which the absorbent vessels are there left, renders them unable to remove the secretion into the cellular tissue produced during the acute stage, which leaves a tendency in the part to a recurrence of the inflammation, an increase of the swelling, and explains the progress of this to the monstrous size often attained. The skin covering such diseased parts naturally participates in the repeated attacks of inflammation becoming much thickened, and undergoing various morbid alterations.

The appearance of the parts affected with elephantiasis is little known, as pathologists have few opportunities of dissecting them, from the disease being slow in its progress, and not dangerous in its result. When such opportunities occur, it is usually when the parts have arrived at a great size, when the acute symptoms are absent, and the different tissues affected are so much altered, that

it becomes very difficult to distinguish the original cause from its consequences. Such a complication in the morbid parts has a tendency to lead the theorist into error, as the disorganization of parts affords him an opportunity of adding what he may require to explain that which may be found erroneous.

When the diseased part is examined at an early stage during the continuance of a paroxysm, the hard varicose appearance of the veins indicates their being inflamed, with the consequent consolidation of their contents.

The length of time the disease has continued will modify the degree and extent of the thickening and degeneration of the skin, and the quantity of serum and solid secretion in the subcutaneous cellular tissue. In all such cases, however, the veins at their extremities will appear larger and more numerous than usual; and from their connexion with the lymphatic system, these vessels will appear, as in all dropsical cases, more developed than usual, and the glands enlarged. In a case dissected by Dr. Hendy, the lymphatic vessels of the upper part of the foot were much increased in size, so that those ramifying on the top of the foot were the size of a large quill, as well as those on the inner ankle. When injected, they appeared much distended, and burst on being filled with mercury. The deep lymphatics, and those which followed the course of the tibial artery, were nearly natural, and the lymphatic glands were pale, flaccid, and covered with a gelatinous fluid. These appearances of the lymphatics are such as will generally be found when dropsical parts are examined, but they do not explain the occurrence of acute local inflammation.

CASE.—Buddum Dass, aged 24, says he has taken mercury for syphilis accompanied with buboes. A number of painful glandular swellings appeared over the body from exposure to cold a week ago. These swellings were more numerous in the mammillæ, axilla, arms, hams, and groins; but without any œdematous swellings of the distended parts, like that of elephantiasis.

In the case above referred to Dr. Hendy found the small veins thrice their natural size, and the smaller arteries were likewise dis-

tended, but the larger trunks were nearly of their ordinary size.[*]
Dr. Hillary [†] gives the following as the state in which he found
the blood-vessels, in a case in which he dissected a part affected
with elephantiasis. The blood-vessels of the skin were much en-
larged in size. The coats of both veins and arteries were very con-
siderably enlarged, so that such as were naturally small branches
of the artery, were here pretty large vessels ; insomuch that when
he amputated the leg he was obliged to take up no fewer than
twelve branches of arteries (?) with his needle, although the leg
was taken off above the knee, and the swelling, in which the vessels
were much more distended, reached no higher than the patella, so
that the vessels were distended even in the thigh, where no swelling
appeared. The femoral artery, where it was divided, was very
large. Such appearances seem to be owing to the repeated attacks
of inflammation, affecting particularly the veins, which are thus left
thickened, tortuous, and of a larger size than natural, and the great
swelling to the repeated accumulations of serum charged with a
larger quantity of albumen in proportion to the acuteness of the at-
tack and the frequency with which it had occurred. When inflam-
mation is not present, a large quantity of serum will be found, which
in some cases will coagulate into a jelly when exposed to the air,
as in the case related by Dr. Hendy. [‡]

M. Bouillaud relates the case of a woman who suffered much
from great and hard swelling of the inferior extremity, which was
found on dissection to have been produced by an obliteration of the
crural veins and the vena cava. In another case he found such a
swelling occurred, " with a varicose state of the veins of the leg," [§]
I presume, after an inflammation of these vessels.

The prevention of elephantiasis would require a system of living
which the poor Hindoo has neither the energy nor means to put in
force; and when labouring under it, his occupations, his lassitude,
and predestinarian opinions, prevent him having recourse to any
means of controlling the inflammatory attacks, and removing a

* Loc. cit. p. 136.   † Ibid. p. 309.
‡ Loc. cit. p. 136.
§ Archiv. Gen. de Médecine, tom. 6, p. 567, referred to by M. Rayer, Maladies
de la Peau, tom. 2, p. 426.

swelling which does not much incommode him, particularly when he supposes it purifies his body from vitiated humours, and that any means to cure it are dangerous.

For these reasons the disease is generally allowed to take its natural course in the natives, until the degeneration of the skin, the extensive disease of the vessels, and the great swelling of the cellular tissue, with the occurrence of sores, prevent him following his occupations, and make him anxious to have the diseased part removed. In such a state of disease a long systematic plan of treatment is required, which, even if most successful, requires attention which a native has rarely the perseverance to pursue. When the scrotum is affected, it involves other organs which are of greater value to them, on which account I have found them much more tractable and persevering than they otherwise would be.

The indication of prevention and cure of elephantiasis is the avoidance of the influence of the predisposing and guarding against the effects of the exciting causes.

When the disease is seen during the acute stage, the treatment should be commenced by the exhibition of an emetic, followed by diaphoretics and purgatives, combined with anodyne medicines when the irritation is severe, and a strict observance of the antiphlogistic regimen, with the part kept in a horizontal position. Should the person be seen in the cold stage, if plethoric, and the fever run high, venesection is to be employed to an extent varying with the case; but in native patients most reliance is to be placed on the application of leeches along the course of the inflamed veins, followed by the application of heat combined with moisture. In other cases the part is to be covered with linen wetted with an evaporating wash. The feeling of the patient should regulate the state of the wash which is applied. Scarifications made in the inflamed part will often be found of great use by unloading the diseased vessels, evacuating part of the morbid secretion, and restoring the balance of the circulation, and thus assisting nature in the removal of the swelling. The steam-bath to the leg, or fomentations and poultices. to the scrotum, to which opium may be added with great advantage, diminish the pain and inflammation. In all cases much advantage will be obtained from shampooing and frictions of the leg for a considerable time with liniment. saponis, and

then applying tightly a flannel roller from the toes to the thigh. The natives employ with great success the irritating leaves of the *nishinde* (inchur or samal) tree, and then bandaging the leg tightly. For the same reason blisters along the course of the inflamed veins will be of great use, by diminishing the cause of the swelling, and thus aiding powerfully in arresting the disease. With these means purgative medicines are to be exhibited.

Between the attacks of fever means should be employed to remove the swelling, and prevent a recurrence of the attack. .

The advantage to be derived from the topical evacuation of the serum is exemplified in the case related by Dr. Hendy (Case XXII. p. 132), in which the scrotum burst during a severe paroxysm. Six or eight ounces of fluid being received into a basin, it was somewhat discoloured with blood. When examined an hour after, it was found that the whole had coagulated, and had a milky appearance, intermixed with the discoloured livid fluid, which had also coagulated. A few months after this the patient had another attack, attended with a similar discharge from the scrotum, in consequence of which the part was nearly reduced to its natural size. He has not since had any return of the disease. I have seen several examples of the same natural evacuation by the bursting of the swelling during a paroxysm, which mitigated the symptoms, and for a time seemed to arrest the progress of the disease. But when the sore dried up, the fever recurred as before. In the plan of treatment which I followed, I always found great advantage from keeping up a sore over the diseased vessels, to act as a counter-irritant, as well as to drain off the large quantity of secreted fluid. This may be accomplished by keeping open blisters, setons, or issues. The latter I have generally employed, from their being less dreaded than setons, and being more certain and permanent than blisters. While their discharges are thus promoted, the absorption of the swelling is to be assisted by the horizontal position, by frictions, graduated pressure by means of sticking-plaster and rollers, the general health being promoted by living in a dry equable climate, eating nourishing and easily-digested food, and the bowels kept open by means of mercurial aperients and laxatives, combined with some diuretic and diaphoretic medicine. Advantage will also be derived from the employment of sulphureous mineral water exter-

nally and internally, diet-drink and bark, and sulphureous fumigations and douches.

The inconvenience, distress, and incurable nature of elephantiasis, and the local nature of this great deformity have induced surgeons to amputate the part; and although I have seen this done with success, it is only in rare cases that it ought to be had recourse to; the disease is of the symptomatic class of inflammations, the local effects of which will be liable to be produced in other parts of the body, and there are cases on record in which amputation was followed by a recurrence of the disease in other and more vital parts of the body, in such an aggravated form as to endanger the life of the patient. M. Rayer * has related an interesting case in which a limb affected with elephantiasis was removed by the knife; but the disease recurred a few months after the operation, in a much more aggravated form, in both arms. The swelling was removed with much difficulty, and almost certainly, not permanently, by a very active and long-continued antiphlogistic plan of treatment. Dr. Hendy's opinion, † that it invariably attacks some other part of the body when amputation has been had recourse to, seems to me to be too general an assertion; but the fatal result of such an operation, related by him, ‡ should make the surgeon hesitate before he has recourse to the knife, unless under peculiar circumstances.

Order III.

SPECIFIC FORMS OF DROPSY.

It will be sufficient in this place merely to mention, that the dropsy produced on the decline of scarlatina is an example of this form of disease. Produced by a peculiar specific disease, it is in general very easily removed by the usual remedies for dropsical complaints.

---

* Traité des Maladies de la Peau, tom. 2, p. 438.
† Loc. cit. p. 17.   ‡ Ibid. p. 136.

CHAPTER II.

ASTHENIC CHANGES IN THE BLOOD.

The want of a due quantity and proper quality of the blood is no less pernicious to health than a too great abundance of healthy blood. In both cases the powers of the system become debilitated, the circulation languid, and syncope, spasms, &c. precede the fatal terminations of the diseases that are then engendered.

When the body is not adequately nourished, owing to a want of proper food, or to frequent bleeding, to a diseased state of the chylopoetic viscera, chronic diseases, poisons, climates, &c. the blood is found changed in quality and diminished in quantity. In this state it is generally of a rose colour when circulating, and it is thin, coagulates quickly, and has a pale, soft, gelatinous-looking cruor, from a diminished quantity of fibrine and red globules, and an increased proportion of serum. In such a state the body becomes emaciated, the surface pallid, and the animal and mental functions diminished in strength.

In this weak state of the body, when the waste is small, the nervous sensibility is diminished, the circulation becomes slower, and the blood is often found darker and thicker when first removed. An example of this is seen in persons in the state of trance; in whom, from the torpid condition, enough of nourishment is obtained from the solids of the body to make up the waste, as the functions of digestion are totally suspended. Hibernating animals afford another instance of such a state of things; here the motion of the blood is hardly perceptible, and in this case the insensibility is so complete, that when removed from their resting-places, they may be wounded without experiencing the least pain. When warmth is applied, the circulation increases, and they become sensible to external injuries. In cases of swoons, &c. the heart and lungs cease to act, with impunity to life, from the blood retaining its vitality in the quiescent state. Were it not for this property, it would in such circumstances coagulate or die, from the long period it sometimes remains at rest. As the vitality is in a state of weakness, in such cases it is necessary to apply heat, and expose

the body to the influence of the surrounding media with care, as a too sudden exposure to a somewhat high temperature in particular, is liable to destroy the individual when the affection is general, or to produce inflammation and the death of the part when the torpor is local.

In many forms of this asthenic class of diseases the cruor appears large compared with the serum; but on a more careful examination, it is found that its soft and friable state is in consequence of a modified quality of the fibrine, which in coagulating does not squeeze out the usual quantity of serum.

In some diseases the cruor is small in quantity, and so very soft, that a slight agitation reduces it to a fluid state; in other cases there is no coagulum, but a few flocculi swimming in the serum; and even these coagulated portions are sometimes wanting, so that when removed from the vein the blood appears as a serum, with a red, brown, or dark matter mixed with it. " Atque interdum," says Celsus, " sanguis profluit, interdum simile aquæ quiddam, in qua caro recens lota est."—Lib. iv.

In good health, the globules of blood are round, transparent in the centre, and of an equal diameter. In persons worn out by disease, and whose organs have undergone perceptible alterations, the globules are less numerous, smaller, and of an irregular and unnatural form, from changes in the constituent parts of the blood, and its soft and diffluent state.

By the assistance of the microscope the globules of the blood in disease are sometimes found few in number; in other cases they are deformed, opaque as if united together, or preternaturally enlarged; and in a third class of diseases they cannot be made out on account of their being broken down.

Anæmia.

This disease is caused by a diminution in the quantity and consistency of the blood in general, and a deficiency in its red particles in particular. This may be produced by a weakness or morbid state of one or more of the organs which form the chyle, or from some failure of the processes which complete the formation of healthy blood in the lungs. The state may be connected with weakness

of the lacteals or absorbents, on which account they do not take up the chyle in the usual quantity ; or it may be produced by breathing air unhealthy from being impregnated with deleterious substances, especially when the individual is weakened by chronic diseases. In such cases, as in diarrhœa, old cases of dysentery, or other like drains on the system, the body loses materials faster than nourishment is introduced into the system.

Such a disease is indicated by the pallid appearance of the skin, lips, &c. and by the absence of the usual proportion of red particles in the blood, in which state the body becomes weak, languid, and torpid, followed by vertigo, faintness, palpitation of the heart, and impaired action of the organs in general. The solid parts become flaccid from want of nourishment, the pulse is slow and feeble, but quick and irregular on any excitement, the memory is impaired, and the intellect weakened, the appetite is diminished or unnatural, digestion weak, with flatulency and constipation, the skin feels cold and dry, or is in many cases covered with cold perspirations.

In such a state of the circulating fluid there is a want of the proper stimulus for the performance of the healthy action of the body. The chylopoetic and assistant chylopoetic viscera are supplied with blood of a weaker nature, which produces an enfeebled action; the chyle is weaker and less nutritious than in health, and when taken into the system, is converted into blood of a less perfect constitution than usual, and inadequate to support life. In this manner the symptoms of anæmia are continued.

Blood of an inferior formation may depend on the small quantity of nutritious matter taken into the stomach, or from its imperfect digestion, so that it is not duly assimilated into blood. In this state the cruor of the blood is small in quantity, and soft, with little fibrine, and the serum is in a larger proportion, with a smaller quantity of saline matter.

The great weakness of the powers of life is indicated by the thin and serous appearance of the blood, and the great diminution of the crassamentum. Such a state of the system is often followed by a dropsical state of the limbs, which increases with the progress of the disease. As the weakness increases, the debility of the absorbents increases more than that of the vessels which secrete their

attenuated fluids which form dropsy, and thus hasten the fatal termination.

Toughness in the cruor is a good test of strength or tonicity in the blood. Many of the inferior animals, as the dog, &c. have a higher degree of organic vitality, or a greater power of consolidating the blood so as to stop hemorrhage, than man, and in this case the power varies with the individual's strength. As the quantity of coagulable lymph diminishes, the disposition to hemorrhage will increase, as in scurvy, for it is the lymph which gives tone and consistence to the circulating fluid. Hence bark, acids, &c. by giving strength to the system, and increasing the quantity of coagulable lymph, are often the best means of removing the hemorrhagic state.

In certain states of the body in weak individuals, symptomatic inflammation sometimes occurs, accompanied with want of coagulation in the blood, so that reaction, and the prominent local and general symptoms of inflammation are not produced; this is mainly from the morbid concentration of vitality in particular parts in such cases. Hewson found that the blood in a woman, the subject of fever after parturition, did not separate into serum and crassamentum. Mr. W. Hey (on Puerperal Fever) relates two fatal instances in which the blood was found in a dissolved state on dissection. These peculiarities apply particularly to cases in which several predisposing and exciting causes of inflammation occur, as in the aged, or those debilitated by previous ill health, or in the course of diseases in which the sensibility is much impaired, as in continued fevers. M. Laennec says, " Les pleurisies les plus graves sont celles des sujets les plus debiles, des cachectiques, des hommes affoiblis par des excès quelconques, par la syphilis, la goutte, le scorbut, le cancer, et surtout par l'age."* In all such cases the determination to one particular part of a larger proportion of the more vital part of the blood diminishes so much the vitality of the remainder as to render it incapable of performing properly its offices, whereby the weakness and danger of the disease are increased.

In some diseases this want of coagulation is peculiarly evident, as in the scorbutus which follows from persons living a long time on

* De L'Auscultation, &c.

salt meat without any vegetable substances. It has been supposed that the want of coagulation in the blood was owing to the large proportion of saline ingredients in the blood which such food produced; and this opinion was further confirmed when it was found that recently drawn blood lost its coagulating property when muriate of soda was mixed with it. But a more careful chemical examination of the blood has proved that such changes in the saline principles do not take place, and that the want of coagulation in the blood, and the predisposition to hemorrhage, are produced by the relaxation and debility which the want of nourishing food produces. By such causes the quantity of blood in the vessels is diminished, and the nerves become subject to morbid stimulus, and the secretory organs are supplied with blood, attenuated, and inadequate to its offices.

In consequence of these changes in the blood, the system is affected with general languor and weakness; the patient suffers from shortness of the breath, he feels an indisposition to motion, and has stiffness of the joints and swellings of the limbs; on different parts of the surface of the body blotches or ecchymoses appear, like those produced from bruises, undergoing the same changes of colour, and often ulcerating. The gums swell and are spongy, and frequently bleed, as do the different mucous tissues in general; the teeth become loose, and often fall out. There is peculiar fœtor of the breath, as when exhausted by want of sustenance, and of the alvine secretions, which are mixed with blood; circumstances which show a strong tendency to putrescency in the fluids.

As the disease advances, the patient complains of great debility. He becomes much emaciated, and with the appearance of ulcers, old cicatrices and even unions of bone often give way again, indicating the greater activity of the absorbents than of the secreting vessels.

Death seems in this disease to take place from inanition; or the disease is combined with other maladies, which much increase the danger.

The long use of salt provisions would appear to act by the debility they produce; but the same effect occurs when salt is taken into the system in excess in any other way. Dr. Huxham* has

* Philosophical Transactions.

related a very interesting case of a girl 16 years of age, who took a pint of salt water for ten days to remove a pimple on her lip. At the end of that time a discharge took place from the uterus, and from the groin; petechiæ appeared upon the breasts, and livid spots upon the arms. As the menorrhagy ceased, the bleeding from the gums increased. She was bled from the arm, and the blood resembled what is called putrid gore. This morbid fluid continued to ooze from the wound, and as it could not be stopped, the arm mortified.

In scurvy many of the internal organs are found on dissection to be gorged with fluid blood, which is of an extreme tenuity and bright rose colour. Ecchymoses of this changed blood are found under the skin and mucous membranes, in the cellular tissue, and in considerable quantities in the serous and synovial cavities, into which it had exuded during life.

Dr. Mead relates *, that in the beginning of scorbutus, the blood as it flowed out of the orifice of a wound might be seen to run in different shades of light and dark streaks. When the disease increased it ran thin, and seemingly very black; and after standing sometime in the porringer it turned thick, of a dark muddy colour, the surface in many places of a greenish hue, without any regular separation of its parts. In the third degree of the disease it came out as black as ink; and though kept stirring in the vessel, its fibrous parts had only the appearance of wool or hair floating in a muddy fluid.

In dissecting bodies that had died of scurvy, the blood in the veins was so entirely broken, that by cutting any considerable branch you might empty the part to which it belonged of its black and yellow liquor. When found extravasated it was of the same kind; and lastly, as all other kinds of hemorrhage are frequent at the latter end of the calamity, the fluid had the same appearance as to colour and consistence, whether it was discharged from the mouth, nose, stomach, intestines or any other part.

This dreadful disease is produced from the want of the just proportion of recent animal and vegetable food, and the too free use of salted substances; so that on leaving these off, and using healthy,

* Medical Works, p. 332. Dublin, 1767.

nourishing vegetable diet, persons are speedily recovered, while their cure is retarded by everything that depresses the vital powers, such as cold, mental anxiety, &c. These things are explained by the influence of most neutral salts when mixed with blood removed from the body, which prevents its coagulation. The most powerful salts are the nitrate of potassa, the sulphate or muriate of soda, &c. These agents seem to diminish vitality, and to modify the peculiar chemical action of the fibrine, by which it is coagulated more slowly, and still no buffy coat is formed. Death takes place in general from inanition; and the blood is commonly found on dissection remaining fluid; the viscera are soft, and easily torn, and gorged with pale, watery-looking blood. The muscles are flaccid, and the bones soft and uneven.

The dissolution or softening of the cruor of the blood occurs in typhus and yellow fever, in which there is great prostration of strength. The blood, says Dr. Tweedie in his excellent clinical observations on fever, has a loose cruor, small in proportion to the quantity of serum, and is so soft that it breaks readily on attempting to raise it, resembling in consistence half-boiled currant jelly, and when abstracted late in the disease is scarcely coagulated at all.

In the yellow fever, says Dr. Stevens, the blood is found to contain a large proportion of serum, which is often reddened by the colouring matter of the blood, the globules are easily deranged, the fibrine is in small quantity, and of a soft consistence. As the disease advances the colour of the blood is lost, and the whole circulating current becomes black, and so thin that it has no longer any resemblance to healthy blood. In this state of the blood it is found to have lost most of its saline matter. Such a state of the circulating fluid explains the want of necessary stimulus to the vital organs, the loss of tonicity of the vessels, and its exuding through their coats, and thus producing passive hemorrhage or the gradual oozing of blood from the extremities of the vessels, particularly under the skin and mucous membranes.

In malignant fever, which is generally accompanied with petechiæ, the cruor is so broken as to deposit a sooty powder at the bottom of the vessel; the upper part being either a livid gore, or a dark green fluid, which quickly and imperfectly coagulates into

a soft, jelly-like mass. The serum is likewise blackish or tinctured with red.* In such cases the red globules seem broken down and form a turbid mass, like that of blood which has become putrid out of the body. In such cases the blood has a peculiar smell, contains little fibrine, and the albumen coagulates with greater difficulty than usual.

The excretions may in such peculiar cases of debility become so fœtid as to give the name of putrid fever to the disease.

Numerous cases on record prove that towards the fatal termination of bad fevers the vital energy may be so weakened, and the disease be of such an inveterate nature, that the blood may even become putrid. Fevers, we have seen, have been called by this name from the fœtor of the excretions; but we shall find that in certain debilitated habits of body, and weakness of the vascular system, the blood becomes putrid even before death.

The following interesting case is related by that accurate observer Dr. Stark, who fell a victim to his ardent pursuit of science.†

CASE IV.—A woman, aged 20, was seized with shivering, followed by fever; she became dull, heavy, stupid, and sometimes delirious; she had a violent purging, her tongue and eyes were parched, her pulse quick and small, and there were petechiæ on the right arm; she was quite neglected till the tenth day of her illness; she died on the eleventh, and immediately after death a change of colour took place in the body. This discoloration was principally on the right side, from the breast to the middle of the thigh, and from the linea alba to the spine; the upper and lower parts and belly were green, the black livid, and the pudenda quite black. A considerable quantity of muddy liquid followed incision made into any of these parts, of the same colour as the part, which was easily torn. This discharge was so intolerably fœtid, that a man had almost fainted from smelling it. The blackness of the pudenda penetrated to the cellular tissue and fat, and the green colour of the abdomen extended to the fat and oblique muscles. The livid colour of the back extended to the bones, near which a few muscular fibres retained their natural colour. There were a few red specks in the arm and breast of the right side.

After visiting this woman, Dr. Stark became for a minute blind and confused, but he suffered no inconvenience afterwards.

* Huxham, Air and Epidemics, vol. ii. p. 68.
† Works, p. 53, edited by Dr. Carmichael Smith. Lond. 1788.

An ounce of the putrid fluid, with 3 drachms of water, was afterwards injected into the crural vein of a healthy bitch. In a minute she vomited; in an hour after she trembled; in half an hour afterwards she seemed in the greatest uneasiness. She frequently vomited during the day and night, and the following morning she moved slowly and feebly when called. She could hardly keep her eyes open, her hair stood on end, and she refused food. She gradually recovered.

In another case,* Dr. Stark examined the body of a young man who died of a fever resembling the preceding. The skin of the left breast was brown, and the pectoral muscle had lost its colour and was rotten. The liver was also so friable, that a very small force only was requisite to push the finger into any part of it. The other abdominal viscera appeared sound.

Soon after examining this body Dr. Stark felt an acute pain at the end of the finger which he had pushed into the liver, it inflamed, and a small piece of it near the nail became black and mortified, and after a few days was thrown off by suppuration.

CHAPTER III.

MORBID CHANGES IN THE BLOOD FROM EXTERNAL ADMIXTURES.

1. Action of poisons inserted under the skin or absorbed by mucous membranes.

In this way the poison of syphilis, hydrophobia, serpents, &c., morbid animal secretions, and certain other poisons, act on the system and produce their morbid effects, often of a most dangerous nature, through the medium of the blood. Under this head should be considered various deleterious substances taken with the food, and which act speedily as poisons, or in a more gradual manner, such as the long use of salt provisions in distant voyages, producing scorbutus, &c.

Certain substances gradually introduced into the system produce changes in the blood; mercury, when taken by certain persons,

* Loc. cit. p. 54.

produces emaciation, tremors, &c.; lead gradually introduced into the system produces constipation, frequent vomiting, severe pain in the abdomen, with wasting and palsy of various voluntary muscles, &c.

2. The direct influence of air mixed with morbid substances, and so taken into the lungs, produces changes in the blood, which are followed by certain effects on the system. By admixture of such morbid matter with the air, as malaria, and emanations from diseased persons, a large and very important class of diseases is produced. By malaria, intermittent, remittent, and continued fevers are produced, and sporadically or by contagion, typhus fever, small-pox, measles, scarlet-fever, hooping-cough, &c.

CHAPTER IV.

MORBID CHANGES IN THE BLOOD.

1. *The Introduction of Natural Secretions into the Blood.*—The vessels of organs have certain vital properties, by which they secrete fluids, which differ from the blood which supplies them. The bile and urine are examples of this; and when the secreting organ is diseased or imperfect, the principles of these secretions are found in the blood, and are thrown out of the body by other channels.

In icterus the blood contains the colouring matter of bile, somewhat modified in its passage into the system. In these cases the modified bile acts as a narcotic upon the brain. The secretions of serum, and of the skin and kidneys are generally affected in these cases, and contain a portion of the same modified matter of the blood.

The suppression of urine, and its probable partial absorption into the blood, produce coma, and sometimes death. In the generality of such cases this dangerous consequence is prevented by its being modified in its passage into the circulation.

Milk is said to have been found in the blood.

2. *Morbid Secretions.*—The changes which the vitality of the extremities of the arteries effect in their contents give rise to substances entirely different from the circulating fluid. Thus in diabetes, the nicest chemical analysis cannot detect any sugar in the

blood, though the substance is generally found in such quantities in the urine. It is therefore necessary that the organs should be defended by their vital properties from the influence of these peculiar substances; and we have already seen how powerfully the system is defended by the consolidating property of the blood, and by the adhesive inflammations set up in the tissues. Dr. Wollaston found the saccharine principle so changed as to be quite indistinguishable in the blood, which in diabetes was found to contain more serum and much less fibrine than natural.

3. *Air in the Blood.*—In the land and sea tortoises, in some fishes, in the hedgehog, viper, &c., air bubbles have been observed in the circulation.* Many of the tissues of the human body are pervious to air, and a considerable portion of it constantly exists in the body during life, subject to increase and diminution according to the pressure of the atmosphere, in the same manner as it exists in water.† The air, by its elasticity and pressure within, corresponds with that without, unless the balance be in some way destroyed. Hence, by its escape, the parts after death are specifically heavier than during life. The air which pervades the body accounts for the quantity sometimes found in the blood-vessels after death; that which the body contained during life makes its way into these empty canals. The structure of the coats of veins, and the manner in which death takes place, seem to be the reason why air is generally found in the veins, especially in those of the brain.

The opinion of Dr. Darwin, that air is not contained in the blood during life, does not appear correct; nor is much reliance to be placed in the experiment he relates of securing a portion of the jugular vein of a pig between two ligatures, and placing it under the exhausted receiver of an air-pump, as proving this opinion correct; for although there is no turgidity produced, nor any appearance of bubbles of air, by allowing the blood to flow into a cup of water previously exhausted of its air; this must be supposed to be owing to the very small quantity of blood acted on, and the imperfect manner in which such an experiment could be performed.

In almost every dead body more or less air is found in the veins.

* See Morgagni de Sed. et Caus. Morb. Epist. V. 22.
† Dalton, Edin. New Philos. Journal, No. 25, p. 92.

Morgagni* found all the veins inflated with air, in the body of a young man. In the body of a man who had been affected with amentia, the inferior vena cava was so distended with air that fingers could be introduced into it.† Baillie supposes that the vena cava contains air more frequently than the other veins.

These, and numerous other instances on record, in which air is found in the bodies of persons recently dead, seem to prove that Mr. Dalton is just in his conclusion of the blood containing air, in regard to the nature of which we are still ignorant.

4. *Worms in Blood-Vessels.*—In some ancient authors are to be found descriptions of worms said to have been found in blood-vessels; but from the imperfect accounts we have of such worms, the difficulty of seeing them, &c., it has been supposed that portions of fibrine or other accidental admixtures were mistaken for worms. Such cases have been recorded by Borellus,‡ de Castro,§ Kircher,|| &c.; but the existence of such worms has been considered very problematical. More authentic and accurate descriptions will be required before we can believe in the existence of such worms in the blood-vessels; more particularly when the industrious and sagacious Rudolphi, Bremser, and many other observers, have directed in vain their research to this point. Such facts, indeed, by no means disprove the assertions of those who mention the occurrence of these worms; but in reference to such a curious, unlooked-for circumstance, it permitted the profession to suspend their decision until further proofs were brought forward of its accuracy.

It is now an established fact, that in some of the inferior animals such worms are sometimes found, and it is therefore by no means improbable that future observers will find them, in some rare cases, in the vessels of the human body. This curious question, indeed, seems now to have been put to rest by the publication of a case by Mr. J. S. Brisbane, surgeon at Dumfries.¶ This gentleman removed six ounces of blood from the arm of a sickly boy eight years

---

* Epist. 30, Art. 2.   † Acta Med. Berolini, vol. 7.
     ‡ Obs. Microscop. 3.   § De Febre Petech., S. 1, § 15.
|| In Arte Magna Luc., lib. x. p. 2, c. 8, § 5, p. 832; and in Mand. Oubit. lib. 12, S. 1, c. x. p. 351, and Sect. 2, cap. 7, p. 370.
¶ See his pamphlet in Dumfries Courier, Dec. 11th, 1833; or India Gazette, 27th May, 1834. No. 1092.

of age, in an attack of epidemic influenza.   On the blood coagu-
lating, five animals were found swimming in the serum, and ap-
peared vigorous and lively.   On dividing the clot others were dis-
engaged, so that thirteen were counted in this blood; and in some
blood previously removed fifteen were found. They lived two days
in the serum.

"These animals exactly corresponded in structure, colour and
size to the larvæ of the Tipula oleracea, which in summer is so
abundantly found in ditch and river water. The eggs of these flies
are very minute, and at a certain season of the year are deposited
in great numbers in running water by the Tipula fly, well known
by its long legs and slender body."

The frequency of parasites in the alimentary canal prepares us
for examining those cases in which they are found in different other
parts of the system.   In these cases the ova seem to be taken with
the food, and those of peculiar kinds in certain states of the body, are
then changed to more perfect forms. In certain cases these minute
ova may be absorbed, and may find their way into the larger circu-
lation and be developed there. In these cases they may be expected
to be found in parts where the circulation is weakest, and probably
remain in their situations, and avoid the violent action of the heart
and the force of circulation in arteries. This was probably the case
in the example above quoted.

When the ova have been conveyed into the circulation it may be
easily comprehended how the same ova may be deposited and the
animal developed in the cellular tissue of the body. This appears
to be the manner in which the Dracunculus or Guinea worm (Gor-
dius) is evolved in certain low, damp, unhealthy situations, when
the larvæ are numerous in the water. The very numerous animal-
cules that occur in the drinking water at certain seasons, prepare
us to believe in the quantity of ova that must be swallowed. These
being absorbed with the chyle are deposited in the cellular tissue,
when they enlarge, and the worm passes with considerable quick-
ness from one part of the body to another.   Dr. Smytton saw one
pass in a few weeks from the shoulder to the wrist.* This is done
by the worm forcing its way along the cellular tissue, at the same

* Med. and Phys. Society's Trans. vol. i. p. 188.   Id. p. 186.

time that it produces such a degree of adhesive inflammation as prevents any bad consequences following. In this manner these worms seem sometimes to pass into serous sacs. Dr. Smytton relates the case of Gunner Jackson, who died of a chronic visceral disease, in whose body two full-grown Guinea-worms were found in the cavity of the abdomen; one of them was attached by one extremity to the peritoneal covering of the liver, and the other, which was writhing and alive, in a similar manner, to that of the left kidney, but otherwise floating loose among the viscera.

The frequency with which insects are found in the aqueous humour of horses is explained in the same way as the above; and an example of animalcules occurring in the aqueous humour of a girl has been related. By this passage of entozoa through organs we can understand the manner in which they are found in different organs in the body.

M. Andral has related the case of a man 55 years of age in whom acephalocysts were found in the pulmonary veins. The man had lived on food that afforded little nourishment, and had often felt the sharp sting of misery; in consequence of an affection of the heart he was admitted into the Hôpital de la Charité.

The two lungs were filled with a great number of hydatids, and the entozoa were contained in the pulmonary veins. Several of the hydatids were lodged freely in pouches which had a shining surface. Others were several times folded on themselves, and being contained in small canals had an oblong figure. The surface of these canals was shining like those of the large pouches, and ramified like the vessels. Each of these pouches had a small vessel arising from it, which was also more or less dilated. In the course of the pulmonary veins dilatations were found containing hydatids, contracting in one place to their natural size, and again enlarging for the accommodation of new collections of the entozoa. The largest pouches were of the size of large nuts, and the smaller of peas. They existed in both lungs.

The hydatids had all the characters of acephalocysts; several presented white spots on their surface, others had numerous miliary granulations on their internal surface; most of them were broken. Around the cysts the pulmonary tissue was healthy and crepitated; at other places it was thickened and even hepatized.

A large hydatid cyst of the size of an orange, with cartilaginous parietes, was found in the substance of the liver, and contained eight or ten acepholacysts.

The right cavities of the heart were considerably dilated, and the parietes of the right ventrical were affected with a slight degree of hypertrophy. It is not unnatural to suppose that the presence of a great number of hydatids in the pulmonary veins had impeded the circulation, and contributed to the development of the aneurism of the heart.*

* Journal de Physiol., t. 3, p. 69.

PART II.

DISEASES OF VESSELS.

These diseases may be arranged according as they are of arteries, veins, and capillaries.

BOOK I.

DISEASES OF ARTERIES

Will be described according as they are produced by inflammation of the parietes of Arteries, and its influence on their contents; by alterations in their form, by rupture, and by wounds.

CHAPTER I.

INFLAMMATION OF ARTERIES.

The trunk of an artery is composed of an external cellular tissue, more or less dense; of a proper coat consisting of circular fibres placed closely together, and forming a strong tissue of a brown colour, joined by elastic cellular substance to the fine internal semi-transparent membrane, which resembles a serous tissue, and like it, is smooth on the inside. The arterial tube thus formed is elastic, so as to accommodate itself to the state of the circulation, and is in a certain degree of distension and elongation during life, which facilitates the action of the heart in propelling the blood. There is, however, a considerable difference in the tissue, according to the age of the individual, and the size of the artery; the coats of the larger being denser and stronger, and the smaller more transparent, elastic, and susceptible of irritation; to enable them to accomplish their functions of increasing and diminishing in size,

U

and of modifying and secreting, in more or less quantities, their contents. Arteries are likewise supplied with nerves from the ganglionic system, which affect the character of the diseases to which they are liable.

The inflammation of arteries may be considered as acute, and chronic.

SECTION I.

Acute Arteritis.

The large trunks of arteries being much better defended from external injuries than the smaller branches, and possessing a lower degree of organization, are less subject to inflammatory affections. In some cases, apparently from the anatomical structure and pathological sympathy, the large arteries may become affected by the extension of the inflammation along the large veins, the heart, or a neighbouring serous tissue ; and a number of small arterial branches may be inflamed in the course of an attack of sphaceles, frost-bite, the revulsion or imperfect development of measles, scarlatina, etc. In other cases the capillary arteries are chiefly affected in organs, especially of portions of the liver or lungs, which become filled with consolidated blood, and, if the cause be severe, it breaks down, and terminates in abscesses. Such examples of inflammation are the consequence of constitutional causes, more particularly of the rheumatic and gouty diathesis, or some forms of febrile disturbance ; particularly in the puerperal condition, when the blood is more loaded with new materials than at any other term of life ;[*] in the chronic form of Bright's disease,[†] in certain atmospherical influences, in a bad habit of body, advanced age, and exhaustion of the vital powers, produced by living on bad food, following intemperate and luxurious habits, debilitating diseases, etc., which produce a tendency to inflammation of the arteries. A mechanical class of causes, such as wounds, bruises, ligatures, etc., produce a more local effect upon the arteries, and afford a better example for examining the influence of inflammation upon the tissue of the vessel. In such cases the reddening, thickening, and softening of the tissue, followed by a deposit of lymph, and the formation of a conical consolidated portion of blood, prevents bleeding ; but should the

---

[*] Simpson, Obstetrical Works, v. ii. p. 70.
[†] Taylor, Medical Chirurgical Transactions, v. xxviii.

inflammation be kept up in the part, it may pass to the stage of softening and ulceration, which produce secondary hemorrhage.

The symptoms of an inflamed state of considerable arteries are generally vague and uncertain. They often commence with a feverishness, generally a rigor followed by anxiety, irritation, and restlessness. There is an unusual throbbing pulsation, with a dull shooting pain in the part, resembling rheumatism, and aggravated by motion and pressure, along the course of the vessels. In the progress of the disease the pulse is very frequent, wiry, hard, and irregular, with intermitting pains, anxiety, and often dyspnœa. The countenance of the sufferer appears shrunk and cadaverous, with an appearance of œdema. This is followed by great weakness, cold perspirations, numbness, loss of pulse, and in many cases terminates fatally, and if involving large trunks, in sudden death.

From the obscurity of the diagnosis, it is seldom the physician has an opportunity of treating the diseases of trunks of arteries, which should be of an antiphlogistic nature, varied, and commensurate with the severity of the symptoms.

There is less difficulty in the diagnosis of inflammation of the smaller and more superficial trunks of arteries, particularly in old persons. In such cases there is an absence of pulsation, an increase of heat, redness, sensibility, and cord-like .hardness along the course of the vessel, with burning, pricking, and shooting pains, and a disposition to dry gangrene of the limb. A cooling and soothing treatment, with fomentations and poultices to the parts, are found the most successful plan of treatment in these cases.

The appearance of the effects of inflammations on the arteries after death, is redness of their lining membrane, sometimes in patches, and obstruction, often for a considerable distance, with consolidated blood, more or less changed in its appearance. This requires to be distinguished from the redness produced after death, by being stained by its contact with liquid blood. In certain diseases, and in a soft and putrid state of the tissues, this sometimes occurs, and is produced by a condition quite opposite to that of inflammation. To distinguish these two appearances, the previous history of the case, and the condition of the body, will afford useful hints, while the degree and extent of the redness, its being confined to streaks on one side, the presence of liquid blood, and the facility with which

the stains are removed by washing, proves that the parts had not been inflamed.

The determination of blood to the inflamed vessel produces a reddish colour; and the arteries being more highly organized than the veins, the acute primary symptoms are more quickly followed by other changes in the inflamed parts; the secretion into the internal surface is modified by an increased vitality of its contents, so that it has a larger proportion of coagulable lymph, and finally, a consolidation of blood in the vessel. But as the arteries are full during life, and their contents in a great degree homogeneous in the large trunks, it is rare that deposits take place upon their internal surface, unless under peculiar circumstances; and when a secretion of layers or patches of coagulable lymph takes place upon its internal surface, it is the most incontestible, and with ulceration, is the most certain one, of inflammation having been present.[*]

In a fatal case of phlebitis, I found the internal surface of the great arterial trunks near the heart, of a uniform red colour. This diffuse inflammation appears to prove fatal in most cases before any lymph is thrown out upon its internal surface. Dr. Farr found, in the body of a man who had died of pleurisy and pericarditis, the internal membrane of the aorta covered with lymph, which adhered intimately to it.[†] Bouillard and Bertin found in the body of a man with hypertrophy of the heart and pericarditis, the internal membrane of the aorta red, and covered with a layer of semi-concrete albumen of a red colour.[‡] If acute inflammation occurs in an artery, it is accompanied with a consolidation of blood, particularly where it is out of the more direct current of the blood in the heart, or upon its valves, particularly of the right side. As these deposits increase slowly, they possess a degree of firmness that prevents their being detached, and may form nuclei of larger concretions, that will be considered in another section.

When the inflammation has continued some time, the cellular tissue of the artery is thickened, and becomes more vascular and friable than in a state of health. In this condition, any unusual or sudden stretching of the artery may lacerate it, as occurred in the aorta in a case that will be afterwards related, where it was obstructed in its descending portion.

* M. Laennec, Traité de l'Auscultation, tom. ii. p. 607.
† Hodson on the Arteries.   ‡ Op. Cit. Obs. 2d.

In more chronic cases, lymph was secreted, and consolidated blood was deposited in such quantities, as to render the caliber of the vessel impervious; and in this manner large arterial trunks are obliterated. Kreysing relates the case of a patient in whom the right branch of the pulmonary artery was obliterated in a young man, who had always a blue or livid face.* Spangenberg found the caliber of the aorta reduced to a very small size from the secretion of " coagulable lymph" after aortitis.† In this case the acute symptoms had continued for some time, but no consolidation had taken place, from the force of the circulation. Godisson has recorded an example of an aorta being completely obliterated, and the circulation carried on by collateral branches.‡

SECTION II.

Chronic Arteritis.

This disease of the arteries most frequently occurs in the old, and in males especially, when the constitution has been enfeebled by intemperance, syphilis, or the abuse of mercury.

In a case of chronic arteritis I found the internal coat of all the trunks of the arteries of a scarlet colour, about a line in thickness, soft, of a villous appearance, having lost its smooth shining surface; the cellular tissue had also become denser, thicker, and less elastic, more vascular and friable than in health. When a ligature is passed round an artery in such a state of inflammation, the tissue is divided across by the gentlest means; and from this state of irritation, ulceration speedily follows, and secondary hemorrhage will generally ensue, in consequence of the discharge of the ligature before the vessel is sufficiently defended by adhesive inflammation. Such a fact is of great practical importance by pointing out the danger of tying inflamed arteries, and the advantage of healing wounds connected with arteries, as soon as possible, by adhesion, while everything tending to increase the inflammation is to be removed: hence the danger of using large ligatures, and the advantage of always employing them as small as is commensurate with strength; and, in cases of secondary

* Krankh des Herzens, tom. iii. p. 122.
† Ob. referred to in Horn's Arch. p. 269. ‡ Dub. Hosp. Reports, 1818, p. 194.

hemorrhage, after operations, the necessity of taking up the artery at some distance above the bleeding part.

Softening of the tissue of an artery may take place in the internal coat, and in a circular spot. In other cases, the inflammation, softening, and ulceration extends to the middle coat, and the vessel being weakened, may be enlarged by the impetus of the blood; or it may be lacerated, and its lips projecting inwards into the vessel, and from the secretion of lymph the vessel may be partially or entirely obliterated.*

A more unhealthy or *symptomatic* form of the inflammation of arteries sometimes occurs in adults, or beyond the middle age, with diseases of the liver and kidneys; or when the constitution is weak, with a bad habit of body, supposed to be of a gouty or rheumatic diathesis, from the nature of the pain. This extends along the diseased vessels, which are swollen, thickened, and painful, particularly on pressure or motion, accompanied with more or less fever. The limb becomes wasted, cold, numb, and pulseless; and should stimulants be applied, they readily excite inflammation, which speedily passes to gangrene. In such cases, after death the vessels of the member are found contracted, their coats thickened, and filled up with firm dark-brownish consolidated blood, and is the cause rather than the effect of mortification. ·

Ulceration.—Inflammation of the tissue of arteries softens them, and sometimes to such a degree as to terminate in ulceration, which may either commence in the internal tissue of the artery, or in the neighbouring parts.

When an ulcer commences in the internal coat of an artery, it is generally of an irregular circular form, and often only extends through the internal coat. In other cases, inflammation, softening, and ulceration extend to the middle coat, and the vessel being thus much weakened at the part, enlarges by the impetus of the blood, and forms an aneurism.

In other cases the ulceration extends through the tissue of the vessel, so that, when it is large, a fatal hemorrhage follows. On examining the body of George II. of England, who died suddenly, it was found that the aorta was ossified at the inferior part of its arch, and dilated above, where it was as thin as the finest paper. At this part it had given way, and fatal hemorrhage followed.

* Turner, Med. Chir. Trans. of Edin. vol. iii.

Another form of ulceration in arteries, of much practical import-
ance, is where it extends from the neighbouring parts to the vessel;
inflaming, softening, and ulcerating the coats of the vessel. In
other cases the pressure of tumours upon the artery, particularly
of those in the head, may produce such a thinness of its coats as
to render it incapable of resisting the pressure of the column of
blood. Dr. Yelloly found the basilar artery so ruptured;[*] and
Mr. Wilson saw a case in which the ulceration, accompanying
an old suppurating bubo, extended to the femoral artery, and
destroyed a portion of its tissue, followed by hemorrhage.[†] Such
cases occur in individuals in whom the resources of nature are
much weakened in the course of severe diseases, as sloughing
ulcers, etc., when the usual defence by adhesion, and the formation
of granulations do not take place.

A weakly young man, of phthisical make, was admitted into
hospital on account of varicose veins in the leg, which had
ulcerated, and from his walking about, had become very painful.
The ulcer was the size of the palm of the hand, of an irregular
oval form, extending from the sole of the foot for some distance
above, and on each side of the internal malleolus, having elevated
and highly-inflamed borders. Soon after admission the ulceration
extended to the anterior tibial artery, and a large hemorrhage
followed before the vessel could be secured. The artery was first
attempted to be tied at the part ulcerated, but it was found that
the ligature divided the softer tissue of the artery. The actual
cautery was then applied, but the first scar came away with the
iron, and it was only after a much deeper application that the
hemorrhage was arrested. After lingering for a week, the patient
died.

On dissection, the arteries were found redder in their internal
membrane than natural; and the open extremity of the posterior
tibial had a small slough of an irregular figure lying over it. The
veins, from the femoral downward on the side of the ulcer, were
found filled with consolidated blood. This, when divided, was
found of a pale, hard, whitish appearance near the centre, and
could be easily separated from the internal coat of the veins.

In this case the irritation from the ulcer had extended to the
veins, causing consolidation of the blood, and to the more vital,

* Med. Chir. Trans. vol. i. p. 186.   † Lecture 15, p. 400.

and more actively inflamed artery, which had proceeded beyond the adhesive inflammation. The consolidated blood had been removed, and ulceration established, accompanied by the fatal hemorrhage which is so frequently the cause of unsuccessful operations. The present case affords an example of the impropriety of applying a ligature to an artery when softened by inflammation, instead of exposing and securing it at some distance from the diseased part.

In some of these cases the diagnosis is very difficult. A young man of delicate constitution, after exposure to cold, complained of pain in his shoulder; and when he applied for assistance, a pulsating tumour was found in the axilla from a deep abscess, which extended outwards near the artery. As it was considered to be an aneurism, the subclavian artery was secured on the outside of the scalenus muscle. Secondary hemorrhage occurred from the softening and ulceration of the arterial tissue, and the patient died. An imperfectly formed consolidated portion of blood was found in the artery, and a small round ulcerated opening in its coat, from which the fatal hemorrhage proceeded. In this, and in the case related by Mr. Liston in the London Med. Chir. Trans., the disposition to ulceration was hastened by the irritation which the operation produced in the vessel. These cases prove the importance of a correct diagnosis before securing the artery; and in cases of abscesses in the neck, or near large arteries, the advantage of giving free vent to collections of pus, and healing up such abscesses as quickly as possible.

Thickening.—From the effects of chronic inflammation arteries become thickened in their coats, which are less fibrous and elastic, and more opaque than in their natural state. These changes are produced by the deposit of lymph into the cellular tissue between their internal and middle coats. This deposit is usually of a light colour, and in some cases, when the cause has been more acute, a purulent looking matter can be squeezed out.

Tubercles.—In some arteries small circumscribed, opaque, oval-shaped thickenings of the cellular and middle coat of arteries are found, which form slight elevations on their interior. In such cases the artery is more or less ossified, and in some cases I have found the internal coat of the artery ulcerated over these swellings. In other cases the enlargement has an atheromatous, or steatoma-

tous appearance. Morgagni found in, the aorta of Trombelli a tubercle the size of a nut, which formed a prominence in the interior of that vessel. On dividing it, it was found to contain a matter like the yolk of an egg. Scarpa calls this isolated polypiform substance steatoma of the arteries.

Bone.—In dissecting arteries we often find small oval portions, more opaque, and denser than usual. These spots are of different sizes, and of considerable thickness near their centre, but diminish toward their circumference, which adheres intimately to the internal membrane. By maceration these deposits are found to be formed in the cellular tissue, connecting the inner with the fibrous coat of the vessel. When examined more carefully, their central thick portions have all the characters of cartilage, and are frequently found occupied by ossific deposits. The smaller branches of arteries, having a higher organization, and being more fibrous than the larger trunks, in which, and particularly in the aorta, these ossific deposits are more frequently found, than in the pulmonary arteries. The semilunar valves of the heart are oftener found ossified than any other part of the vascular system.

The deposit of bone is frequently found in the arteries of old people, and sometimes in young subjects. Mr. Wilson found *ossific* deposits in the arteries of a child under three years of age ;* and Mr. G. Young found a bony incrustation in the artery of an infant of fifteen months. From the variety of deposits occurring in the less vital trunks, and not in the branches of arteries, in the debility of old age, and not in the vigour of youth, they are not to be considered as the products of inflammation ; but, rather of a certain degree of irritation, in a part predisposed to such deposits. In most cases they are in the form of points, scales, or rings, according as the deposit has taken place in the cellular tissue between the tissues, or in that joining the circular fibres together. These rings and plates sometimes extend so as to form tubes, which may extend to most of the arteries of the limb. In other cases the deposit is more local, and form tumours in the inside of the vessel, with an irregular surface, and the internal membrane abraded.

The effects of these ossifications will differ according to the part of the arterial system affected. When the semilunar valves

* Lecture, p. 375.

of the aorta are ossified, the orifice of that vessel is contracted, and sometimes active, sometimes passive aneurism of the heart is the consequence. As the large trunks of arteries have less tonicity than the small branches, ossifications of them are less liable to produce bad consequences; but when, in the course of operations, such branches of arteries require to be secured with ligatures, it is often found that the process of union does not take place favourably. The tissue being brittle and converted into bone, the parts soften and ulcerate quickly, and so give rise to secondary hemorrhage. To avoid as much as possible such a dangerous occurrence, it is of advantage, in such circumstances, to use a larger and broader ligature than usual, so as to compress without cutting through the brittle artery, to bring its opposite sides together, and so produce a greater degree of adhesive inflammation before the separation of the ligature.

The ossification of arterial trunks is less liable to be followed by dangerous consequences than when branches are so affected; in consequence of the less degree of tonicity in the trunks, which are also less easily torn than branches during the continued movements of the body. A crack taking place in an ossified artery, from the breaking of one of the spicula, is apt to extend by ulceration, and this weakened part of the vessel to enlarge to the round aneurismal swelling.

When the ossification occurs in the head, where there is little space for the formation of aneurism, the disease is usually followed by the early bursting of the vessel, and the effusion of blood, producing apoplexy. As in this case the dangerous symptoms are not caused by the distension of the vessels, but by the effusion of blood, which can only be checked, or its consequences mitigated, by the strength of the constitution; and as it also generally occurs in aged individuals, bleeding should be used with greater circumspection than in the youthful. After reducing the force and velocity of the circulation, we must avoid weakening too much the strength of the system, by which the wound in the vessel is to be closed, and the extravasated blood absorbed.

When ossification in the branches of arteries is general and extensive, it retards the circulation of blood in the member, and in the old produces the peculiar form of gangrene named *gangrena senilis*. This effect will consequently depend on the state of the

constitution of the individual, and on the degree and extent of the inflammation of the vessels in the member.

SECTION III.

Changes in the Contents of Arteries by Inflammation.

The force with which the blood flows in arteries, and the form of these vessels, generally prevents the consolidation of blood. In the heart, or about its valves, deposits of consolidated blood may take place soon after parturition, in dangerous attacks of inflammation, in scurvy, etc.; and under particular circumstances, portions may be detached and hurried on with the circulating fluid to a smaller artery, and form the nucleus of a deposit, which enlarging, may obstruct the vessel, when the circulation would be carried on by the collateral branches.

This is particularly the case in the pulmonary artery, which is thin like a vein, and is more frequently diseased than is generally supposed. From its structure and position, it is rarely inflamed; and examples of atheromatous and osseous deposits are seldom found. Dr. Crawford has recorded a case of ulceration of this artery.[*] Dr. Hope found it dilated;[†] and an example of an aneurism of its branches is in the museum of St. Bartholomew's Hospital (No. 90), with a deposit of consolidated blood.

Such obstructions in the pulmonary artery more frequently hasten death, or even destroy life, than is generally supposed. M. Baron in France,[‡] and Mr. Paget,[§] the able surgeon of St. Bartholomew's Hospital, London, directed the attention of the pathologist to the frequency and danger of such obstructions. As these arteries convey venous blood, and only anastomose with each other in their smaller or capillary branches; the effect of pneumonia is to consolidate circumscribed portions of the arteries, and by the increasing obstruction, gradually produce hypertrophy of the right and left ventricle of the heart, with more or less warty vegetations of the aortic, and mitral valves. Examined by the microscope, they

---

[*] Med. Chir. Trans. vol. xxvi.   [†] Diseases of the Heart, 1831.

[‡] Recherches et Obs. sur la Coagulation du sang dans l'artere Pulmonaire et ses Effets.—Arch. Gen. de Med., sec. iii. t. ii. p. 17.

[§] Paget on Obs. of Pulmonary Artery.—Med. Chir. Soc. Trans., London, vol. xxvii. pp. 162 and 280.

are found to consist of glanular and lobecular matter, with cells resembling the white corpuscles of the blood.   After pneumonia, and in the puerperal state, when the tendency in the blood to con-solidate is greater, portions may thus form on the valves of the right ventricle, or between its fleshy columns.   These are friable and easily detached, and produce distressing or even fatal effects. Mr. Adam found the pulmonary artery extremely thin, and enlarged to nearly four times its natural size, in an elderly patient, who had died very suddenly.   In this case there was found an organized polypus, extending from the semilunar valves four inches along the artery, of which the circumference was not less than seven inches.   A rupture of the artery had taken place "in the middle," and had caused instant death.   On further examination, there appeared an opening in the centre of the polypus, through which the blood was transmitted from the ven-tricle to the lungs.   M. Baron relates the history of a patient who was suddenly seized with symptoms of asphyxia during convales-cence from pneumonia ; he died in five or six hours, and " nothing could be found to explain his death, except some soft non-adherent ' clots,' which obstructed the cavity of the pulmonary artery."*
Professor Simpson relates the case of a weak female suffering from an old chest complaint, in which the heart participated ; as indicated by cough, palpitation, a mitral bruit, etc., who died suddenly of what appeared at first to be a fainting fit.   On examining the heart, the mitral opening was found narrowed, with a portion of consolidated blood occupying the mitral opening, and partly obstructing it, while smaller portions hung in the auricle. The accidental impaction of this mass, or detached portions, may cause sudden death.   By the obstruction in the pulmonary vessels, such a shock may be given to the system as to cause death ; as occurred lately in a princess of the late royal family of France. This is a rare occurrence ; as the vital power which deposited, will generally again absorb such concretions, and not detach them, as dead matter in mechanical tubes.†

When the consolidation of blood in the smaller branches is more extensive, besides œdema of the lungs and cavities, the

* Lecture c. p. 17.
† See several interesting cases in Professor Simpson's Obstetrical works, vol. ii. p. 34.

patient becomes weakened, from so little of the blood being oxydised; and from this want of fresh blood on the brain and heart, the patient dies as from asphyxia, after experiencing difficult breathing, and violent palpitations, a feeble, small, and quick, irregular pulse, erysipelatous patches on the face and legs, sloughing of the parts which are pressed upon, and great weakness.

On examination after death, the pericardium and pleural sacs contain some fluid, and the remains of inflammatory adhesions and deposits, with the blood either fluid or coagulated in soft black masses, and the tissues of the heart weak and pale. Many small branches of the pulmonary artery were blocked up by old cylindrical, or short portions of consolidated blood, pale, and firmly attached to the artery. They have often the appearance of organized consolidated blood, adhering to the walls of the vessel.

Similar changes take place in the branches of the aorta. In a preparation, exhibited in 1849 by M. Langier to the Anatomical Society of Paris, a needle had been thrust through the apex of the heart, into the cavity of the left ventricle. The needle was found after death, fixed with its long axis, running vertically from the apex of the heart towards the aortic orifice of the ventricle. The patient, a young man, to whom this accident happened, died with gangrene of the left leg; and it became an interesting pathological question, What was the relation between the cardiac injury and the gangrene of the limb? The dissection seemed to resolve this problem, for the whole length of the needle, projecting into the cavity of the left ventricle, was covered with decolorized, irregular concretions, which were prolonged beyond the apex of the needle into the cavity of the aorta. The lower end of the aorta and the iliac arteries were filled with adhering sanguineous concretions. " And it occurred," observes Cruveilhier, " to all the members of the society who saw the preparation, that some of the clots formed around the foreign body in the left ventricle of the heart had been projected forward from it into the arterial canals, and become there the nuclei of new obstructing concretions." * Another explanation may be hazarded. The foreign body causing such an irritation in the system as to produce inflammation in the arteries, particularly of the inferior extremities, where they were predisposed to it, which terminated in gangrene.

* See Cruveilhier's Traité D'Anatomie, t. xxiv. p. 201, 296.

It thus appears that dissipated habits, a rheumatic diathesis; in the puerperal state, when the blood is overcharged with fibrin; in diseases of particular organs, as the uterus, lungs, and extremities, the extensive consolidation of blood, not unfrequently terminates in gangrene. In one case of a middle-aged female subject to rheumatism, and debilitated by privations and dissipated habits, the vessels of the four extremities were filled with consolidated blood, and threatened with gangrene, when death put an end to her sufferings. Such a state may be considered analogous to cases of unhealthy symptomatic inflammation, forming large concretions in frost-bitten parts, gangrene, etc. ; which, for a time, retain a certain degree of vitality, are cured with difficulty, on account of the person's weakness, and they advance slowly until the circulation is stopped, and gangrene takes place. Professor Simpson has related the following instructive case :*—A female, twenty-four years of age, a day after having aborted, was seized with severe headache, giddiness, dimness of vision, and vomiting. The fingers of the left hand felt as if scorched, and were extremely painful. On the following day the dimness of vision continued, and there was intense pain and numbness of the left arm, which at length became cold and insensible to external impressions. The wrist and tips of the fingers were discoloured, especially the top of the ring-finger, which was turning black. On examination, no pulsations could be felt in any of the arteries of the arm above the affected hand, but the subclavian was distinctly felt pulsating above the clavicle. There was no perceptible disturbance of the action of the heart, and no embarrassment of the respiration. This patient eventually recovered, with the loss only, by gangrene, of the integuments of the thumb and fingers of the left hand. In three days the power of vision was restored. The pulsation of the obliterated arteries of the left hand never returned; but the arm itself gradually regained its sensibility and ordinary plumpness. In this case the heart appeared healthy.

The veins of the liver, from inflammation or morbid tumours, produce consolidation of blood, and a morbid change in the structure resembling the tumour. Drunken and dissipated persons, exposed to the inclemency of the weather, and privations of various kinds, are very liable to these morbid changes ; which are indicated

* Lecture c. vol. iii. p. 55.

by emaciation, dropsy especially, ascites and anasarca of the lower extremities.

Obstructions, varying in colour and hardness, are sometimes found in the cerebral arteries, in connection with vegetations in the aortic and mitral valves. They are generally situated at the bifurcation of the basilar artery, where it gives off branches.

Large portions of these fibrous deposits are sometimes found in the vessels of the kidneys and spleen. The abdominal aorta has been found obliterated by changed, consolidated portions of blood. Crampton, Louis, Bougon, Desault, and Duncan have recorded cases of such obstructions.

CHAPTER II.

ALTERATION IN THE FORM OF ARTERIES.

These alterations are either a diminution, or an enlargement of the arteries.

SECTION I.

Diminution in the size of arteries.

These peculiarities may be considered as congenital diminution of arteries, and as occurring during life from physiological or pathological causes.

Congenital closure of the descending Aorta.
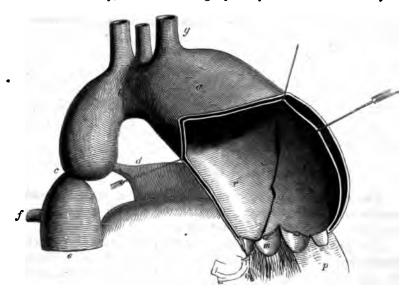
The examples of congenital contractions of arterial trunks, usually occur near the heart, at those parts which undergo considerable change in their size after birth.

The descending aorta is the most frequent example of such a peculiarity. M. Paris has related in Desault's Surgical Journal the case of a woman, in whom the aorta below the ductus arteriosus was so reduced in size as scarcely to admit the entrance of a common writing pen, and immediately under this part, it again enlarged to the natural size. The parts under the contracted portion were supplied with blood by the communications of the subclavian and axillary arteries, with the intercostals, the diaphragmatic, the epigastric, etc.

Dr. Graham has recorded another case,* in which the aorta, after expanding unusually near its origin, so as to form a kind of pouch, and giving off branches to the head and superior extremities, was preternaturally contracted, immediately after its union with the " canalis arteriosus." At this point it was completely impervious for a line in breadth. Under this constricted part, the artery again expanded to its natural size. Its coats appeared healthy.

The following is another example of this remarkable obliteration of the principal arterial trunk of the body, without its producing any apparent marked effect on the size or strength of the parts upon which the artery was distributed, from the circulation being carried on by anastomosing vessels :—

CASE.—A strong middle-aged Hindoo, while walking, suddenly fell down, and expired. Dr. Rae, who obligingly gave me the preparation, examined the body, and found a large quantity of blood in the cavity of

the chest. In following the course of the aorta, which is now before me, it was found enlarged (at a and r); and after leaving the heart, and giving off the innominata, and the left carotid and subclavian arteries, it suddenly contracted for a line in breadth (at c), as if a ligature had been

* Medico-Chirurgical Transactions of London, vol. iii.

passed tightly round it, where it was found to be completely impervious under the ductus arteriosus (d), which was also closed. Immediately under this point, the aorta appeared of its natural size (e), into which several enlarged arteries (as f) poured in their blood. The left ventricle was much thicker in its parietes (p) than natural; and on laying open the enlarged ascending aorta, immediately after its leaving the heart, it was found torn in its internal coat for an inch and a half (from l to l), commencing a short distance above the semilunar valves (m), and extending obliquely upwards. By this torn part, blood had been forced between the cellular and muscular coats (as far as b); and into the cavity of the chest, causing the sudden death of the individual.

Where the left carotid artery divided into the external and internal trunk, an incipient aneurism appeared, in the form of a semicircular swelling. On examining this carefully, it seemed to be formed by the blood forcing out the arterial parietes, without having destroyed the inner and fibrous coat. This is by no means a solitary instance, as Mr. Hodson has delineated one of the same kind; and I believe a more extended and careful examination will prove, that this is often the manner in which aneurisms commence. The enlargement of the ascending aorta is another example of the same class.

The circumferences of the different vessels, in Dr. Graham's, and in the case under review, are as follows :—

	Graham's Case.	Present Case.
The greatest external circumference of the aorta near its origin in inches	3.80	47.5
Aorta, after giving off the left subclavian	.80	1.15
—— immediately under the strictured ditto	1.60	2.72
Left subclavian ditto	1.40	1.45
—— carotid ditto	...	.52
Innominata ditto	...	1.50

Mr. Sidney Jones[*] has given the particulars of another case in which the man lived to the age of forty-five years. Nothing was known of him beyond his having been treated for a chest disease, and his lungs showed indications of past inflammation. The obstruction was situated at the commencement of the thoracic aorta, just below the juncture of the ductus arteriosus with the termination of the arch. In the recent state, the obliteration seemed to be

[*] Medical Times and Gazette of 16th May 1857 ; and 14th November 1857, p. 510.

complete, and a ligamentous cord, half an inch in length, united the two ends of the artery. Above the obliteration, a quantity of atheromatous deposit, involving, at that part, nearly the whole circumference of the vessel. The arch of the aorta, and its three arterial trunks, were double their usual size. Four intercostal arteries on each side were the size of a goose-quill, and tortuous ; and by means of the enlarged internal mammary, superior intercostal, inferior thyroid, transversalis colli, and branches to the side of the chest, anastomosed freely, and carried on the circulation.

Mr. Crisp enumerates seventeen cases,* and M. Dumontpallier has met with another example, and has collected the particulars of eleven cases of such contractions of the aorta;† so that there are now thirty cases on record, of this remarkable vascular anomaly. Of those in this country, six occurred in females, and fourteen in men ; and the patients lived on an average to the thirty-third, or died between the seventh and ninety-second year of their age. Such an obstruction is consequently quite compatible with life, and even health. They all appear to have had occasional functional disturbances of the heart, and an abnormal state of the pulse.

Was this closure congenital or accidental? Dr. Graham supposes that his case belonged to the latter variety, and describes a preparation in Professor Patterson's museum, as a proof of such obliterations of the aorta taking place. In this case, a considerable portion of the aorta, just above the bifurcation of the iliac trunks, was filled with " laminated coagula," which extended into both iliac arteries. It is in this manner an obstruction of the aorta takes place in the course of life, from the effects of an acute disease, and extends a considerable way in the vessel : such an obliteration would have taken place immediately after the aorta had given off the large trunks at its arch, or as it began to descend, and not below the *ductus arteriosis*. Besides, the obstruction to such a large artery must have produced marked symptoms during life, and left traces in the vessel of its having been so affected with disease, which was neither the case in Dr. Graham's patient, " nor in the preparation now before me." This was the conclusion I arrived at in a paper on the subject presented

* Crisp's Treatise on the Blood Vessels, p. 31.
† Gazette Med. Nos. 4, 12, 19.

to the Medical and Physical Society of Calcutta,* which is much strengthened by the cases since recorded.

Of twenty of these cases the aorta was abruptly contracted, and there was no disease in the artery beyond what such an obstruction must have occasioned. In the large majority of these cases the closure formed a semicircular termination, and in two of the cases it formed a diaphragm composed of the internal and middle coats of the artery, with a perforation in the centre. Such an obstruction must have produced a degree of fever and irritation, on any derangement of the system occurring, sometimes with a dilatation of the ascending aorta, the carotid, and subclavian arteries ; in seven cases, with an hypertrophy of the heart, and a rupture of this organ in two cases, of the ascending aorta in two, and of the descending aorta in one patient. When the aorta was only partially obstructed, palpitations, dyspnœa, dropsical symptoms, and great pain and uneasiness, sometimes indicated this irregularity during life ;† but when the obstruction was complete, they were less liable to such symptoms, by the peculiar adaptation of nature, from the thickening and enlargement of the heart and arteries, until the middle age of the individual, when their tissue had become less elastic, followed by rupture and death. Near the obstructed part of the vessel, the coats of the descending aorta remained in a normal condition, and it was only at a point where the vessel was obstructed, and also at the ascending portion, that its tissue appeared thickened, by that power of the system which always strengthens weak parts.

Another peculiarity in these cases was, that the obliteration took place exactly in the same position, immediately below the *ductus arteriosis ;* and the obstruction did not retard the development and growth of parts in these individuals, who grew up to the adult state, without any apparent peculiarity in their make. The obstructed circulation was quickly modified to meet the difficulty ; and it was carried on by the collateral branches, which were enlarged at an early age. This explains the free manner in which the circulation must have taken place to the lower extremities, and the individual thus arrived at manhood with his organs strong, and well developed.

* See Transactions, vol. viii. part 2, p. 384, printed in 1842.
† Wochenblatt der K. K. Gesellschaft der Aerzt zu Wien, 1855.

As, however, the body got strong and plethoric, we must suppose
that he would be subject to palpitations of the heart, and painful
throbbings of the arteries of the neck, with attacks of headache,
and occasional fits of dizziness, from the want of a free circulation.
This had caused the hypertrophy of the heart to overcome, and
of the ascending part of the aorta to resist the force with which
the blood was sent into it, when so obstructed by the closure of
the descending aorta.   The nature of the opposing force explains
other morbid consequences :

1st. By the formation of an aneurism at the angle, where the
common divides into the external and internal carotid arteries ; and
this swelling is the more interesting, as it exhibited the enlargement
of the three coats of the vessel without any rupture, which Scarpa
supposed always takes place in these cases.

2d. The second and most remarkable change was the hyper-
trophy of the left ventricle, and the enlargement and thickening of
the coats of the ascending aorta, forming a true aneurism ; which
was not, however, sufficient to resist the force of the blood, and
on the person exerting himself in walking, the aorta burst, and
the individual expired from the loss of blood.

3d. From these irregularities in the circulation, and from inflam-
mation of the coats of arteries, a consolidation of their contents
may take place ; and its partial absorption, accounts for the occur-
rence of the atheromatous, pseudo-cartilaginous, and calcareous
deposits met with in some bodies in the abdominal, aorta, iliac, and
other arterial trunks and branches.

4th. These morbid changes may advance in the course of life.
The aneurisms may enlarge, and afford remarkable examples of the
resources of nature, as in the following case :—

A man about fifty years of age was brought to the hospital quite
dead, in which state he had been found in a retired part of the street.
He had two club feet; the inferior extremities were remarkably small,
and he had been obliged always to go on crutches to beg his food ; the
superior part of the body, on the contrary, was large and well formed.

On opening the body, the venæ cavæ were found distended with blood,
and the pericardium contained six ounces of serum, and recently coagu-
lated blood. The aorta, after supplying the largely-developed superior
part of the body, became contracted in size as it began to descend, at
which point an aneurism was situated, and the lower aperture into the

sac was comparatively very small. In this case, the large quantity of blood was sent to the superior extremities, in consequence of its descent being impeded through the comparatively small-sized descending aorta. The aneurism appeared to have been of long standing, and the aorta was somewhat thickened and small in size, immediately above the upper orifice of the aneurism ; which was formed into two cavities, a larger and stronger next the heart, and a smaller and more recent one beyond this in communication with the first by a large hole. At the apex of this sac a small superficial ulceration had formed, and burst into the pericardium at the point where the venæ pulmonales pour their blood into the left auricle. The large sac rested upon four of the dorsal vertebræ, part of the bodies of which had been absorbed ; at another part the aneurism was so thin that a portion of the substance of the lung could be seen through it. As the circulation had been so direct, no consolidated blood had formed in the sac, which was strong, thick, and elastic, of a pale colour, and lined with the smooth shining membrane, which resembled, and was continuous with, that of the aorta.

Diminution in the size of arterial branches. Such a diminution in the size of arterial branches may take place in parts, when a temporary diminution of the quantity of blood occurs. Thus, the arteries of the mammæ enlarge, and secrete milk, when the uterus has discharged its contents ; and after a time these vessels again diminish in size.

In other cases the usual size of the arteries are diminished, often from some unknown cause. Morgagni found in the body of a man thirty years of age, who had died of dropsy, the aorta of the size of a finger, and the other trunks proportionally reduced in size.[*] Baillie found the femoral artery, immediately under the profunda, so diminished in size that its sides were nearly in contact, without any perceptible disease of its tissue or mechanical obstruction. The collateral branches of the part, in this case, were much enlarged.

In the course of disease, the branches of arteries of an emaciated limb contract, and the part is fed with a diminished flow of blood.[†]

---

[*] Ep. xxx. art. 12.   [†] Morgagni, lib. v. ep. lxv. art. 5.

SECTION II.

Enlargement of Arteries.

These enlargements may be of the arteries in general, of a member, or they may be confined to a particular part of the vessel.

The *general enlargement* of the arteries of a part may be congenital, of which a remarkable example was under the care of Mr. Adams ; which, from the loss of blood, terminated fatally. In this case, all the large vessels of the limb were enlarged. The femoral artery was at least three times its natural size, and the tibials were proportionately large. The veins were so much dilated as to resemble rather large sinuses or blood chambers, than venous channels. Their appearance and size suggested comparison with the sinuses of the uterus. The "coagulum" in one was at least the size of a pullet's egg. This condition, which was found generally in the lower part of the leg, diminished gradually up the thigh. A third of the iliac artery was much larger than natural, but its veins were not so much so. There were atheromatous deposits and aneurismal enlargements in different arteries of the body.[*]

Another enlargement of arteries is on the occasion of growths, or the expanding of collateral arteries to convey the blood to a member when the chief vessel has, by any cause, been obstructed.

Local enlargement of arteries, or aneurisms. — This disease may be produced by a weakness or a wound of the vessel, which renders them incapable of resisting the impulse of the blood, at one or more of these weak points. Such swellings would enlarge with the increased weakness of the opposition, until they burst ; were it not checked in its advance by the irritation in the part, which produces a firm sac formed of condensed cellular tissue, strengthened by layers of consolidated blood in the cavity of the aneurism.

Sometimes the weakness of the coats of the artery extends over the body, and those parts will be more liable than others to become aneurismal, where the impulse of the blood is the strongest, as at the arch of the aorta, where the artery is not supported by neighbouring parts ; and where it is exposed to much motion, as in the axilla, ham, &c. Persons who take violent exercise, and strain themselves, by lifting heavy weights, or from local injuries, are

[*] Med. Times and Gazetteer for May 1857, p. 512 ; see also Brechet Mem. sur d'Anev. Paris, 1834. Obs. iv. § 31.

most subject to aneurisms. Thus Morgagni found that coach-men and post-boys are most subject to them, from living freely, and from the position of their hams in riding, while the impetus of the blood is received on the angle of the popliteal artery in that position. Violent impulse of the heart, consequent upon emotions of the mind and muscular action, may thus produce aneurisms. An officer at Gibraltar, in leaping for joy at the arrival of the ship which was to convey him to England, felt a sudden pain in his groin. No tumour appeared at the time; but six weeks after his arrival in England an aneurism appeared in the groin, which ultimately destroyed him.* These vessels may be weakened by tumours pressing upon them, and by the interstitial absorption that is the consequence. A more common cause is from the deposit of ossific matter, which renders them more easily lacerated, from being less elastic; and this is the cause of their frequency in old age.

Women are less subject than men to the exciting causes of aneurism; and large arteries are more subject to these enlarge-ments than the smaller branches, from the increased impetus of the blood, their weaker tissue, and their being less protected by the neighbouring parts than the arterial branches. The frequency with which arteries are affected with aneurism have been found to occur in the following order:—The aorta and large arterial trunks are most commonly found with aneurismal swellings; which decrease in frequency in the popliteal, femoral, inguinal, iliac, subclavian, carotid, axillary, external iliac, cerebral, and the tibial, lingual artery, &c.

The pulmonary artery, from the venous blood it conveys, and from its form, situation, and uses, is more rarely affected. In only one case did I find it in a state of aneurism soon after it left the heart.

The arteries within the cranium are very seldom affected with aneurism, from their small size, little exposure to violence, and from the brain filling up the cranium. Mr. Wilson had not even seen such a case; and its rarity induces me to relate the fol-lowing case:—William Frederick Hughes, æt. 44, addicted to irregular and intemperate habits, was admitted into St. Bartho-lomew's Hospital, on account of severe pain, with a paralytic con-dition of his lower extremities, which he could move very imperfectly;

* Wilson, loc. cit.

and his urine and fœces were passed involuntarily. His speech was also affected. These symptoms had succeeded repeated apoplectic fits ; from the effects of which he was slowly recovering when he had a severe attack of gastric fever, produced by his friends introducing improper food into the hospital, of which he died. On dissection, the mucous membrane of the stomach was found inflamed, and the vertebral and basilar arteries unusually large, and an aneurism the size of a filbert was found in the artery, where it joined the fissure of Silvius. This had burst, producing the attacks of apoplexy. The other arteries were healthy.

The diagnosis of internal aneurisms is difficult, from the peculiar nature and variety of the symptoms. When the aneurism is external, the symptoms are more unequivocal—the tumour forming a soft, yielding, immovable swelling, which has ·a sensation of general dilatation, with a whizzing noise, when the pressure is removed. The tumour after a time is less yielding, and the stroke is more vibratory and obscure, from the blood's impetus being so much diminished as the cavity enlarges, and from the formation of consolidated blood where the sac is most out of the current of the circulation. Beyond the tumour the pulse is feeble, with coldness, numbness, and œdematous swelling and pain, owing to the pressure of the aneurism upon the nerves and neighbouring parts. In some cases, by the consolidation of blood, the aneurismal tumour may be filled up, and a spontaneous cure follow ; but a more common course is when the tumour increases ; its colour becomes paler, as it approaches the surface, which it does in a direction which varies with the resistance it meets with ; an eschar slowly forms, which cracks, and the person dies of hemorrhage.

The symptoms of internal aneurism are more equivocal as there is no visible tumour, and the pulsation is often not distinguishable until it approaches the skin, when it is detected by the stethoscope, from the pulsation of the artery conveyed by the neighbouring parts. Aneurism of the aorta may be distinguished by strong resounding beats of the heart, synchronous with the pulse, which varies with the size and position of the swelling, and is accompanied in some cases with the " bruit de Soufflet." During respiration or speaking, it often produces a peculiar whistling of the voice, by compressing the trachea or bronchæ, and there is a diminution of pulsatory sound over the chest. The most common form of aneurism affects the

ascending aorta, by enlarging the whole artery, or only a part; which is generally in its anterior or lateral portion, when the arterial action is felt under the sternum, and cartilages of the ribs. The aneurism of the descending aorta is felt along the dorsal vertebræ ; and when the abdominal aorta is so affected, its action is felt more distinctly, and over a larger surface than usual.

These aneurismal tumours press on, and produce absorption of the neighbouring parts, deranging their functions, and impeding their action. They thus may encroach upon vessels and nerves, the œsophagus, bronchæ, &c., and these peculiarities will vary the symptoms present.

Such enlargements, or aneurisms, may be arranged as they are *diffuse*, or *circumscribed* TRUE aneurisms; or *diffuse false*, and *circumscribed* FALSE aneurisms.

1. The first class of aneurisms are either diffuse or circumscribed.

Diffuse true aneurism is the dilatation of a whole artery over a short space, as occurs in large vessels, especially the aorta; or to some extent, as occurs more commonly in small branches.* In this form consolidated blood rarely occurs. The branches of arteries are sometimes enlarged to perform certain offices, as of the uterus during pregnancy, the mammæ after parturition, &c., and the mechanical obstructions to the progress of the blood along the branches of veins.

Circumscribed true aneurism.—This is the lateral swelling of an artery, forming a circumscribed tumour. Scarpa denied that this form ever existed ; but later investigations has proved its occasional occurrence. It is always small in size ; and being produced by some accidental weakness of the part, or mechanical cause, when the impulse of the blood forms the circumscribed swelling. It is rare that more than one aneurism of this kind is found in the same person.

2. The second class are false aneurisms, in which the dilatation of the artery is accompanied with a more or less destruction of its coats, by disease or wounds, and forms the most numerous and most important class of these diseases. They may be distinguished into circumscribed and diffuse aneurisms, and these into primary and secondary.

Circumscribed false aneurism.—When an artery is inflamed, or otherwise diseased, such a softening of its tissue may be locally

---

* An example of each of these forms of aneurism is related at page 297.

produced, that by the impetus of the blood the internal and middle
coats are ruptured, and an irregular swelling formed, by the expan-
sion of the external coat on one side. The deposit of bone in its
tissue may produce this weakness of the arterial tissues. In
these cases, as the swelling enlarges, the external coat is slowly
absorbed, but not until adhesion and condensation had taken place
between the sac and neighbouring parts, which now form part of
its parietes. Should the adhesion be intimate, the aneurism may
continue to form the circumscribed variety; and when the cavity
is enlarged, it forms the second kind, which has received the
name of *diffuse false aneurism*.

In this case the pressure which the blood produces on the sac
of an aneurism, causes an absorption to take place on the external
and least resisting portion. When bone is the tissue that inter-
venes between the aneurism and the surface, the adhesive process
unites the edges of the aneurismal sac, and the absorbent vessels
remove the bone. Should cartilage be next the sac, its absorption
takes place more slowly ; and, *cæteris paribus*, the tissue will
be more quickly absorbed in the inverse ratio of its vitality.
When a nerve is pressed by the enlarging sac, violent pain is felt
in the part, which slowly disappears as it becomes flattened in
figure ; the medullary portion is absorbed at the part pressed,
and the neuralema becomes smaller, and at length disappears.
When a muscle is pressed by an aneurism, its active motion is
impeded, it becomes intimately united to the tumour, becomes
thinner, and altered in its colour, and its structure is gradually
changed into a fibrous-looking substance. When a serous sac
forms the boundary of the aneurism, it is torn in the progress of
the tumour ; and when it approaches the more vascular tissue, the
skin, or mucous membrane, as the parietes of the sac, become
thinner, a portion of the most prominent part of the skin becomes
paler, a slough slowly forms, and in large vessels, when detached,
the patient dies from the loss of blood.

In some cases the extension of the aneurismal sac is towards
the artery which feeds the tumour ; a communication takes place
between them, and thus two channels are formed for the passage
of the blood. Mr. Shekelton has related two cases of such com-
munications.* In one of the examples, it was an aneurism of the

* Dublin Hospital Reports, vol. iii. p. 231.

aorta three inches above the bifurcation in the iliac arteries, into each of which an aperture into the sac was found equal to the caliber of the femoral artery. In the other case, the aneurism was where the aorta divides into two iliacs, and the apex of the oblong aneurism terminated in the external iliac near its commencement.

When an aneurismal sac is examined in the dead body, it usually presents its cavity lined by numerous concentric laminæ of consolidated blood; and the surface of the sac, when examined near its aperture into the artery, is found lined with a smooth internal membrane, which is continuous with the internal membrane of the artery. The sac itself is much thickened and strengthened by different layers of consolidated blood, from the irritation in the sac; and these may occur in such quantity as to fill up the diseased sac, and in some rare cases thus accomplish a cure. This result is usually prevented by the impetus of blood into the sac, at the same time that interstitial absorption, or ulceration, diminishes the thickness of the sac in one part, and leads to a fatal result. The layers of consólidated blood have a darker red colour internally, from their more recent formation ; and are harder and lighter coloured, and put on the appearance of cartilage, when of older formation. In other cases, this cartilage has irregular portions of bone imbedded in its substance.

The changes that take place in the sac vary with its state of irritation, and with the more or less direct manner in which the blood passes into it. When the force is not great, and the current indirect, such a degree of consolidation of blood may take place in the sac as may fill it up. Sometimes the disease progresses very differently, as in the case related at page 300, which affords an interesting example of an aneurism in which no consolidated blood was in the sac.

These varieties in the progress of aneurisms will explain the principle upon which operations are now undertaken for their cure, when occurring in the largest trunks of arteries; which may be tied with impunity, as the collateral branches, especially those that are most direct, swell and carry a sufficient amount of nourishment to parts thus deprived of their natural supply of blood, through the main arteries.

The second indication is to perform the operation when the

tumour is small, and the neighbouring parts little affected, so that the whole blood may be consolidated in the sac. This is accomplished by tying the artery at some distance from the aneurism, where it is easily performed, is in a healthy state, and is distant from large collateral branches. This will be assisted by a small quantity of blood flowing through the sac from the anastomosing vessels, by which the vitality of the blood is not immediately withdrawn from the consolidated portion in the sac, and the absorbents are left free to remove the swelling.

The third indication is when the artery is so deeply situated as not to admit of the ligature being applied between the heart and the tumour ; as was proposed by Brasdor, and ably performed by Mr. Wardrop,* to pass a ligature round the artery, beyond, or distal of the tumour. By this operation the blood is arrested and consolidated by the irritation produced in the vessels, and an aneurism at the root of the subclavian and carotid arteries, and the arteria inflominata and iliac arteries may thus be cured.

In performing such operations the external incisions should be free, and as little of the artery as possible exposed, so as to allow the small ligature to be passed round it and tightened, so as to divide the two internal coats at some distance from the aneurism ; or where we may expect the artery to be healthy.

When a limb is examined some time after the principal arterial trunk had been tied, the collateral vessels are found enlarged in size, thickened, and tortuous in their course, like varicose veins. Such changes are the effect of the increased momentum of the blood in the anastomosing vessels, which are elongated, and rendered more elastic.

These operations for the cure of aneurisms are formidable, and in a considerable proportion of cases fatal ; which has led me to consider the means by which the spontaneous cure of an aneurism is sometimes accomplished. These may take place in various ways :—

1. When a small aneurism is out of the strong impetus of the circulation, such a sthenic state of the blood may exist, that it consolidates, fills up, and so strengthens the sac, that no blood passes through the tumour, and it is slowly removed by absorption. In other cases, the aneurism may be in the direction of the vessel, and

* On Aneurism. London, 1828.

filled up with consolidated blood, leaving a canal through which the blood circulates.* Dr. Monro has described a preparation in the museum of the University of Edinburgh, in which the aneurism of the aorta underwent such a spontaneous cure ;† and in another case, Dr. Goodison found, on dissection, the abdominal aorta obliterated. ‡

2. The arteries proceeding to or from the aneurismal sac may inflame, and be obliterated by being filled up by consolidated blood, and thus accomplish the cure of the aneurism.

3. The enlarged sac of the aneurism, by pressing upon the vessels which enter, or proceed from the tumour, may obliterate them. A preparation, in the possession of Mr. Wardrop, of an aneurism of the arteria innominata, which had obliterated the common carotid artery of the right side ; and if the person had lived, might in like manner have obliterated the subclavian, and so accomplished a cure.

4. From the large size of the tumour, the employment of certain medicines, or from the weakness of the patient, a coagulation of blood may take place, which acts as a foreign body. The tumour becomes painful, accompanied with symptomatic fever of a dangerous character, which is to be removed by an early opening into the aneurism, and the evacuation of the coagula and pus. This may occur without hemorrhage, as the primary effect of such an irritation in the aneurismal sac is to consolidate the blood in the vessels which lead into it. These changes explain the danger of treating aneurisms by the manipulation of the tumour as proposed by Mr. Ferguson.§ In an aneurism of the subclavian and innominata arteries, that able surgeon found that, by displacing a portion of the consolidated blood in the sac, by a gentle but steady pressure with the thumb alternately over the aneurismal sac, and directing some of it to the distal end of the artery, such an irritation was produced as caused a consolidation of blood in the vessel. On the third day, the pulse at the wrist became weaker, and this increased till the tenth day, when the pulsation of the arteries with the arm ceased, the tumour became more solid, and the pulsation diminished. Severe pain was felt in the tumour and along the arm, followed by coldness and partial paralysis, and the arm was slowly restored to its usual state.

* Hodson, Diseases of Vessels. † Edin. Journal of Medical Science.
‡ Dublin Hospital Reports, vol. ii. p. 194. § Lancet for September 1855.

The danger of this method is the suddenness with which such consolidated portions of blood are detached, and fill the distal orifice of the aneurism, which may be followed by rupture of the sac, or even apoplexy ; and when the tumour is large, and a portion of the blood coagulates, it inflames the tumour, and produces dangerous irritative fever.

The above remarks on the spontaneous cure of aneurism will afford useful hints for an improved method of treatment, which may be considered as applying to internal and external aneurisms.

1. The treatment to be pursued for the alleviation of the sufferings, and for prolonging the life of the patient with *internal* aneurism, when direct applications cannot be applied, is to reduce the quantity of blood by small bleedings, to exhibit digitalis to diminish the frequency of the pulse ; and to select dry and nourishing food that is easily digested, and affords such an amount of nourishment, as will promote the formation of consolidated blood in the sac.

This result will be further promoted by the occasional exhibition of saline aperients and tonics, by enjoining a state of mental and bodily quiet, by avoiding everything heating, as wine, beer, &c., so as to moderate vascular action and to ease pain.

2. For the cure of *external aneurism*, when the tumour and the artery, which feeds it, can be reached by the surgeon, the same general treatment is to be pursued as for internal aneurism ; to which should be added applications to reduce the velocity of the fluid in the sac, and to promote its consolidation. This is to be accomplished by methodical pressure over the vessel which passes through the aneurism at one or more points, so as not to cause pain, and at a convenient distance, so as to diminish, rather than entirely to interrupt the circulation in the sac. When from the position of the aneurism, or from the sensibility of the part, pressure cannot be applied proximid, it may be applied beyond the tumour in some cases, with success. While this methodical pressure is produced, a certain degree of irritation is to be applied by irritating oils, blisters, and the like, over the tumour, and the vessel in which the blood is retarded. Such applications will be found in general sufficient to effect a cure, by the contraction of the artery and the tumour, and by the consolidation of the blood, and its gradual absorption, as the collateral circulation is established.

CHAPTER III.

Before considering the artificial means employed for arresting arterial hemorrhage, a few remarks will be premised on the varieties of wounds in arteries, and the means nature employs to arrest the flow of blood.

Since the time Ambrose Paré first secured bleeding arteries by the ligature, many improvements have been introduced by modern surgeons; more particularly by Dr. Jones, who was guided by the genius of John Thomson. They established the following facts :—

When the wound in an artery is transverse, it remains more open, and is consequently more dangerous than an oblique wound. When the transverse wound is small, blood is effused into the neighbouring cellular tissue, and thus stops the hemorrhage, When this obstacle is not sufficiently strong, a flow of blood takes place at each contraction of the heart, until it is so weakened as to diminish the impulse, and the blood coagulates more rapidly as its vitality is lowered. As the weakness increases, the person faints, which allows time for coagulation to go on more completely ; and unless when the artery is very large, or the wound extensive, the hemorrhage ceases. This is promoted by keeping the patient in a recumbent position, raising the injured limb above the level of the body, pressing upon the vessel with a piece of cork, keeping the part constantly wetted with cold water, and regulating the diet according to circumstances.

Such wounds in arteries give rise to two varieties of aneurism, produced by the complete destruction of the coats of the vessel, as by a wound; and they may be designated, the secondary circumscribed, and diffuse false aneurism.

Secondary circumscribed false aneurism.—When a small wound is made in the trunk of an artery, an effusion of blood takes place into the neighbouring cellular tissue, and the wound contracts into a rounded form. Then the blood partially consolidates, and by the adhesive inflammation which the irritation produces, the further effusion is prevented. In such cases a soft circumscribed tumour is formed over the wounded artery, which, if superficial, has a

certain degree of pulsation, and this increases as the irritation diminishes, with the size of the consolidated blood.   The aneurismal sac slowly enlarges, and the pulsations increase until layers of consolidated blood form in the cavity, which, in some rare cases, may fill up the swelling, and thus cure the disease.   The power of recovery in the artery is greater in proportion to the smallness of their size.

From the force with which the blood is propelled from the wounded artery into the cellular tissue, it disperses over a considerable space before such a degree of inflammation takes place as will confine it, and the effusion is considerable, forming the variety named

Secondary diffuse false aneurism. — This swelling pits upon pressure being made upon it.   The pain, at first considerable, often becomes very severe, with stiffness and numbness in the part, from the pressure upon the nerves.   In this case the danger proceeds from the great effusion of blood into the cellular tissue, and the irritation it produces from gangrene, or from the loss of blood.   Such cases are dangerous, chiefly from not having been seen in time, or from improper treatment, and they sometimes assume an extremely complicated form, which requires promptness and decision, as well as experience, as exemplified in the case related at page 45.   The general rule is to enlarge the external wound, remove the coagulum, and secure the wounded artery above and below the wounded part.

When the wound has completely divided the artery, it contracts and retracts by the elasticity of the vessel; and unless it be large, and the circulation powerful, by the formation of the coagulum at the extremity of the vessel, and by the weakness of the system from the loss of blood, the hemorrhage is repressed.   Even when the wounded vessel is large, the weakness that occurs from the loss, and the coagulation of blood will for a time stop the hemorrhage.   But as soon as the patient recovers, the blood again flows, and he faints; and unless it can be arrested, the person dies.   When the wounded artery is smaller, its vitality considerable, and its fibro-muscular tissue and the circulation is weak, the bleeding will stop by the contraction and retraction of the vessel into the irregular cellular tissue of the sheath, and by the formation of consolidated blood from the wound, for some distance into the artery,

or to the next considerable collateral branch. It is to allow the full effect of this retraction and contraction, that the division of bleeding arteries is often employed with such good effect ; and when the wound in a considerable artery is small, by cutting down upon the bleeding part, and securing it immediately above the wound, will be sufficient. But should the wound in the artery be too large to be thus secured, the surgeon must cut down upon the bleeding vessel, and tie it above and below the wounded part. The only exceptions to this rule are in cases of wounds in the palms of the hands, and soles of the feet. In such situations we cannot cut down directly on the bleeding vessels; but the principal arteries supplying the part are to be secured, the clotted blood removed, and a graduated compress placed over the wounded vessel, which will thus be completely commanded.

Such are the powerful means employed by nature to arrest the fatal effects of wounds in arteries in strong adults, that Pelletan has related the case of a young man who was run through the body with a foil in a duel. After the first alarming symptoms were dissipated, by the judicious treatment adopted, he got so much better as to get up, and walk into the garden. Two months after the wound, he was much distressed with pain in the spine, which became deformed ; became rapidly worse, felt suffocated, and died. On dissection, the right side of the chest was found full of blood, coagulated in various degrees ; and an opening, the diameter of which was equal to that of a writing pen, was found in the aorta, above the crura of the diaphragm.[*]

When the small artery has been divided near its passage from a canal in a bone, it may be necessary to plug the hole before the hemorrhage will cease.

As the bleeding from an artery stops, the included portion of blood at the cut extremity consolidates in the contracted tube, and becomes more firmly adherent to the coats of the vessel, particularly near the seat of the wound, where the irritation is greatest. Beyond this it diminishes in size, presents a pyramidal shape, and retains its dark colour, while the base is firmer, and of a paler appearance. When examined some time after, the portion of consolidated blood is found much reduced in size, and changed into

---

[*] Clinique Chirurgicale, t. i. p. 92.

a dense fibrous-looking substance of a pale colour; and the vessel is left small in size, and impervious to blood.

When the artery is larger and more elastic, it will retract more into its cellular sheath ; and when smaller and more fibrous, the influence of contraction will be more marked, and the size of the orifice of the vessel diminished. The distance to which consolidated blood takes place in a wounded vessel will depend upon the state of the part, the velocity of the blood in the vessel, and the distance of the wound from any large collateral branch. The adhesive inflammation excited by the wound in the vessel produces an intimate union between the internal surface and lips, and the consolidated blood which it contains ; but the coagulum higher up or lower down in the vessel contracts to a point, and does not adhere to the internal coat of the vessel. The same adhesive inflammation, by thickening and strengthening the cellular tissue around the wound, still further prevents hemorrhage.

Punctured wounds of arteries are closed by the effusion and coagulation of blood in the neighbouring cellular tissue, by which an alteration is made in the relative situation of the external wound and that in the artery, so that the two are not in the same line ; unless when the wound in the vessel is large and the force of the blood considerable, its effusion will thus cease. The increased vascularity in the neighbourhood of the wound, and the partial consolidation of blood there, permanently close the wound; and this is absorbed by the vessels of the surrounding vital parts, or is gradually changed into a fibrous dense substance, which firmly closes the wound in the artery. This cicatrix differs from the original tissue, being thin, smooth, and transparent ; and from its weakness is very liable to be enlarged by the impetus of blood in the vessel, so as to form an aneurism. In other cases the vessel has been found to give way from the same cause, years after the infliction of the wound. Saviard has related the case of a man who had had the brachial artery wounded twenty years before. He says that the cicatrix partly separated, or rather burst, and a large sanguineous infiltration was the consequence.

The influence of nature in healing wounds in arteries is exemplified in the following remarkable case, related by Dr. Keil:— A Bavarian soldier, in a drunken quarrel, received a stab in the left side of the chest with a table-knife, which was followed by

copious hemorrhage. He was supposed to be dead, and was left for an hour in the cold in the position in which he fell. He was then found bleeding, and apparently lifeless, and was removed to the hospital. The edges of the wound were brought together by adhesive plaster. After several hours he came to himself, and after four months treatment he was discharged cured of the wound, but amaurotic from the large depletion. He led an irregular life, and some months after his discharge he was again brought to the hospital labouring under a severe attack of pneumonia, of which he died. The pleura was found adhering to the lung, which had a cicatrix through its whole extent, and a wound had extended to the ascending aorta. In this was found an irregular opening, a quarter of an inch in length, occupied by a firm coagulum, or rather a consolidated portion of blood. This wound was found to have extended into the vessel, on the inner-side of which a rounded cicatrix appeared formed by the consolidated blood. In this case, the perfect stillness in which the body was left in for an hour, the syncope, and the cold, saved this person's life.*

When nature is insufficient to stop a bleeding artery, artificial means must be employed to save the patient's life. These means may be reduced to compression, ligature, and styptics.

a. Compression, for stopping hemorrhage, may be employed by means of the tourniquet, of Assalini's needle, by a prepared sponge placed in the wound, by compresses, &c. These are generally temporary means of stopping hemorrhage until an opportunity is given for the application of the permanent means. Instruments have been invented for compressing arteries, so as to bring their two sides together; and should they be retained in this manner for about twelve hours, such a degree of inflammation will be the consequence, with adhesion and consolidation of blood, as will obliterate the vessel. This sometimes takes place from the pressure of neighbouring tumours, aneurisms, &c. In this manner, we have seen, aneurisms may be cured, and it explains in what way such pressure is useful.

b. Ligatures of Arteries.—When a ligature is to be placed round an artery, the cut extremity is to be drawn out by means of a tenaculum, or separated from the neighbouring parts before the ligature is to be

* Henks' Zeitschrift, 1837-8. British and Foreign Review, vol. vii. p. 254, for 1839.

passed round it; and this should be to as small an extent as possible,
so as to obtain the objects above mentioned. The ligature is drawn
moderately tight, by which a division of the internal and middle coats
of the vessel occurs, which are kept in apposition. The irritation
produced by the division of the internal coats of the artery, and
the pressure of the ligature, causes a degree of irritation in the
part which unites, by adhesive inflammation, the ends of the artery.
The inflamed part of the vessel near the ligature becomes thickened
in its tissue, and portions of consolidated blood are formed above
and below this part, and adhere to the lymph that is thrown out
around the wound made by the ligature. These changes occur from
six to ten hours after the application of the ligature; its action
in small arteries, and in strong persons, being more rapid, and
the union more perfect, than in the old and weak. It is also
of importance to place the ligature at some distance from a colla-
teral vessel, for an obvious reason.

This ligature, acting as an extraneous substance, should be
small; an ulceration of the compressed part takes place about the
fifth or sixth day, and the ligature is slowly discharged about the
twelfth or fourteenth day, being thrown off by a gangrenous process,
together with a small portion of the vessel which had been com-
pressed by the ligature. Before this time the vessel above and
below has been strongly closed up by lymph and consolidated
blood. This is slowly absorbed, and the vessel then remains
impervious, and generally is afterwards reduced to the state of a
fibro-ligamentous cord to the next considerable branches which
enlarge and carry on the circulation.

In some cases, from some peculiarity of constitution, from the
size and number of the ligatures, the mode of dressing, &c., a
higher degree, and greater extent of inflammation occurs in the
artery, than is required for the adhesive process; and a softening
ulceration occurring, is followed by secondary hemorrhage. This
distressing event happens from the fourth to the tenth day; but
before the bleeding commences it is often indicated as likely to take
place by the degree of inflammation in and around the lips of the
wound, and it may occasionally be prevented by the application of
leeches, cold, &c., to the part, and the use of a cool, spare diet.
Hence the importance of using small ligatures in such cases; but
when the person is old or weak, the artery ossified or diseased,

some of the surrounding cellular tissue may be included in the ligature, by which the chance of secondary hemorrhage will be diminished, the extremity of the artery better secured, and the adhesive inflammation more firmly produced. In all cases in which ligatures are applied to arteries, secondary hemorrhage will be best avoided by perfect quietude both of body and mind, and by the exhibition of refrigerating and sedative medicines.

When the arteries are extensively ossified, or their tissue is soft and inflamed, and they are reached with difficulty, it is often necessary to include some of the surrounding tissue in the ligature. This is particularly the case when the blood proceeds from different mouths that cannot be distinguished from the neighbouring parts. In such cases the ligature should be applied with such force as to disorganise the included part ; on which account the strength of the ligature should vary with the thickness and firmness of the parts, and the degree of irritation to the circumstances of the case. In the old and infirm a higher degree of irritation will be required, so as to ensure the necessary adhesive inflammation. In other and opposite cases the irritating causes should be diminished, lest the degree of inflammation exceed that of the adhesive process.

When a ligature cannot be applied to a bleeding artery, the system may be lowered by tartar emetic, or blood may be taken suddenly from a vein so as to produce faintness, and to such an extent as the patient's constitution will bear. By this means the circulating system will be weakened, and time allowed the blood to coagulate and consolidate.

c. *Torsion*, or the twisting round the cut extremity of the artery, is employed with advantage when the vessel is small. This method was employed with great success by a French surgeon of the name of Donza, during the French wars in the South of India. M. Donza afterwards had the misfortune to have his own leg amputated by an ignorant pretender. Previous to its performance, the surgeon promised to employ torsion. This was done with success ; he lived long afterwards, and died in 1826, at a very advanced age. Amussat, Velpeau, and Tierry, have revived this method, which produces a plug in the vessel, by the torn and displaced internal and middle tissue at the part twisted.

d. *Styptics* were much used by the ancients for stopping arterial

hemorrhage before the use of the ligature was known, which has rendered their employment of more rare occurrence, particularly since the more extensive experience of the moderns has proved that much less reliance can be placed in their efficacy, than was at one time supposed.

One set of styptics dispose the tissue of the vessel to contract, as the infusion of galls, oak-bark, astringent gums, alum, and spirits of turpentine. For a like reason, cold water, ice, &c., may often be employed with advantage; and for this purpose the application must be made for some time, and its power increased by the addition of vinegar, &c., which contracts the fibrous coat of the vessel. In operations, the exposure of the wound for some time to air, and the application of cold, will be of much use in diminishing the number of vessels that require to be secured by the ligature, and in promoting the union of the wound.

Styptics are sometimes employed for the purpose of destroying the vitality of the bleeding vessels, or forming an eschar upon their bleeding mouths. Of such remedies the actual cautery is the most powerful; but others may be in some cases employed with advantage; the nitrate of silver, sulphate of copper, potassa, concentrated acids, oil of turpentine, &c. These styptics, but particularly the first, may be employed with great advantage when numerous small vessels are bleeding and inflamed, when their tissue is soft, and they are surrounded by dense cellular tissue, so as not to allow of their retracting, and of coagula forming to stop the bleeding, and where, from situation, other means cannot be employed to stop the hemorrhage.

Some styptics act by hastening the coagulation of the blood in the open vessel. These remedies are more efficacious, when the blood flows slowly. One class acts by mixing with the fluid of blood, and thus hastening the destruction of vitality, and increasing the firmness of the coagulum. They are called absorbents, and consist of lint, or cotton, flour, cobwebs, sponge, &c. Another class are powdery substances, which act by hastening the coagulation of some of the principles of the blood, as the acetate of lead, &c.

When the hemorrhage is considerable, the local means of restraining it will be assisted by rest, breathing a cool pure air, cooling diet, in small quantities, aperients, and remedies that moderate the force of the circulation. When such an extent of

bleeding has occurred, the patient may be saved by closing, by pressure, the chief artery of one or more limbs, so as to diminish the extent of the circulation, and thus allow the system to rally, and to restore the strength by suitable nourishment.

CHAPTER IV.

RUPTURE OF ARTERIES.

This is a rare occurrence, from the strength and position of arteries. The large trunks in the thorax, and the branches in the head, are most commonly ruptured from concussion of the body, or blows; from diseases of arteries, from aneurisms, or obstructions to the course of the blood.

Mr. Else had the preparation of an aorta in which a small rupture had taken place in its ascending portion, half an inch from its valves; and an old pale " coagulum" the size of a large nutmeg, was situated on its external side. Another rupture, much larger than the first, was situated at the arch of the same artery, behind the origin of the carotid. The edge of this torn part was irregular, and from it a bloody tumour extended, and pressed upon the trachea and branches of the bronchia, destroying the patient by suffocation in less than a month from its commencement, and before there was any appearance of external swelling.* In a case of a man who died suddenly during a fit of passion, I found two considerable openings in the ascending aorta, near its valves. The internal and middle coats of the artery were healthy, and there was no appearance of disease round the ruptured openings.

The rupture of the aorta took place in a middle-aged man from its being preternaturally small in its lower part. In this patient there was an imperfect development of the lower extremities, compared with the large quantity of blood sent to the upper. This produced an aneurism, and eventually a rupture of the aorta, and the death of the individual. Still more interesting cases, produced by a congenital contraction of the aorta at its descending portion, have been related at pages 296 and 300, in which the ascending aorta had burst. Another example was that of a strong, middle-aged bricklayer, who fell from a scaffolding forty feet high. His

* Med. Obs. and Inquiries, vol. iii. p. 177.

face was bruised, and the left branch of the inferior maxillary bone, and several ribs were fractured, but not displaced. He was insensible when brought to the hospital, with the surface of the body cold, and his breathing difficult. He died an hour after the accident. On examining the head, the base of the skull was found fractured from one temporal bone to another. A considerable quantity of recently coagulated blood was found upon the pericardium; and on separating some old and extensive adhesions between the pluræ, the remaining space was found filled with recently coagulated blood, as well as the posterior mediastinum. On a further examination it was found that this extravasated blood had proceeded from a laceration in the anterior part of the commencement of the descending portion of the aorta, at *b*, Fig. 7. Except a few small plates of bone near its origin, the aorta appeared healthy. In another case, the aorta was torn nearly across, in the space between the emulgent and lower mesenteric arteries. The aperture had lacerated edges, and was so large as to admit the point of the thumb. This person seemed to have lived some considerable time after the aorta burst.* In most of these patients the coats of the artery were diseased, or some obstruction existed to the course of the blood.

In another case the wheel of a heavy carriage passed over the trunk of the body, and produced a rupture of the posterior part of the aorta, with a considerable laceration of its internal coat. Atheromatous patches are generally found near these lacerated parts.†

Rupture of smaller branches of superficial arteries may take place from blows, contusions, fractures, or great bodily efforts. Mr. Syme‡ has related the case of rupture of the axillary artery; Mr. Lizars§ of the transverse rupture of the popliteal artery from a fall; and the meningeal artery is sometimes ruptured in consequence of a fracture of the skull.

Branches of arteries are not unfrequently burst in the head from the effects of concussion; and when of any size, the hemorrhage that follows from them usually proves fatal.

Mrs. Harison, æt. 45, complained frequently of swimming in the head after a hasty supper, is supposed to have fallen backwards, and struck

---

* Medical Essays and Obs. 2, vol. iii.
† See Case in the Med. Times and Gazette for May 1857, p. 524.
‡ Edin. Med. and Surg. Journal, vol. i.   § Ibid, vol. ix.

the back of her head upon the floor. Several hours afterwards a surgeon was called in, and found her motionless, insensible, with no pulse at the wrist. A stimulating enema was administered; a large blister applied to the neck, and sinapisms to the feet without any benefit. The collapse continued, and she died during the night. A large effusion of blood was found under the scalp at the back part of the head; and a rupture of an artery at the base of the skull, from concussion, and an extravasation of blood upon the brain, which had produced the rapid fatal result.

The smaller branches of arteries in organs, particularly of the brain and lungs, when affected with chronic inflammation, lose their elasticity, become softened, and are ruptured, producing an apoplectic extravasation—more frequently in the corpus striatum or contiguous parts. A still more frequent rupture of pulmonary vessels occur, and in many instances the bleeding proceeds from a considerable extent of the mucous surface, and not from one vessel.

CHAPTER V.

TORN ARTERIES.

A considerable artery may be torn across by external violence, and does not bleed so much as those that are divided by a cutting instrument; and in some cases, large arteries have been torn across without the occurrence of any hemorrhage. Cheselden has related such a case, in which the arm was torn off by the wheel of a mill, without any hemorrhage ensuing; and Wilson has related a similar case, in which the arm was blown off by gunpowder, without any bleeding supervening. By a wonderful instinct, animals employ this means of dividing the navel string of their young, which would otherwise be liable to die of hemorrhage. The reason of this absence of hemorrhage, in these cases, is the irregular manner in which the extremities of the two inner coats are easily torn and drawn within the outer one, while the tube is diminished in caliber, and thrown into transverse wrinkles; the effect of which is the entanglement of a quantity of blood within the vessel and its sheath, and the formation of a portion of consolidated blood capable of resisting the impulse of the column sent by the heart.

BOOK II.

DISEASES OF VEINS.

The little sensibility and irritability of veins in a state of health, is much increased when inflamed, and is accompanied with considerable danger from their number, their connection with the heart, and their sympathy with other tissues and organs. This danger will be varied according as the inflammation is acute or chronic, which will prepare us for considering the effects of injuries of veins, and the best means of treating the diseases of these vessels.

CHAPTER I.

DESCRIPTION OF PHLEBITIS.

The symptoms of phlebitis are modified by individual peculiarities, and by the special cause by which, in each case, the disease has been produced. They may be more conveniently described as the local and constitutional symptoms, as they appear, after the wound made in phlebotomy, as the progress of this form of the disease is more easily marked.

The first local symptom of phlebitis following phlebotomy, is a sensation of uneasy itchiness and pain in the wound, a few hours after the operation, which is generally ascribed to the tightness of the bandage. It is therefore loosened, and the arm, being left free, is moved about. The irritation is thus increased, and on examination, the wound is found open, with its lips red, swollen, and turned outwards. The arm is found to be tender along the course of the vein, especially near the wound, from which a small quantity of a sero-purulent fluid escapes. I have seen this discharge take place some hours after the commencement of the disease. In general, however, it is several days before pus is discharged unmixed; and it is then most frequently thick, fetid, and in small quantity.

As the inflammation extends towards the heart, a slight swelling, and a red streak may be perceived, and a cord-like substance felt along the course of the vein, attended by an obscure sickening

pain. The redness of the skin along the inflamed vein is produced by the neighbouring cellular tissue participating in the inflammation. In some cases, owing to the deep position of the vein, or the swelling of the surrounding cellular tissue, caused by the absorbent vessels being affected, œdema is produced, and the red streak and cord-like feel, are not well defined. But when these two symptoms appear, they form unequivocal evidence of the presence of phlebitis.

In some instances, the irritation of the wound made in bleeding, extends in a particular manner, to the neighbouring cellular tissue of the arm, which becomes so inflamed and painful as to be incapable of being straightened, and increases the inflammatory fever; while it diminishes the internal inflammation and dangerous typhoid symptoms. In these cases, the cellular swelling has often, at particular points, a peculiar boggy feel of fluctuation, by which I have seen experienced surgeons so far deceived, as to make incisions in expectation of giving vent to pus. After some time, the swelling of the arm begins, either from the effects of the remedies applied, or the strength of the constitution, slowly to subside in the neighbourhood of the wound, while the thick purulent discharge lessens in quantity, and becomes more serous in quality. The acute external inflammation would appear to act as a counter-irritant to the inflammation along the course of the vein; for as it subsides, dangerous constitutional symptoms are developed, and we are enabled to trace the insidious advances of phlebitis, which in the previous stage had been obscured by the swelling of the surrounding cellular tissue. As the disease proceeds, painful circumscribed abscesses often form along the track of the vein affected, or even in distant parts of the body. These continue pale, and when opened, discharge a quantity of thick, often dark-coloured, fetid pus, with great temporary relief to the patient.

Soon after the uneasiness or pain in the wound of the vein is observed, although in some cases not until ten or twelve days afterwards, *constitutional effects* may be perceived. These are generally first indicated · by chills, or sometimes severe shivering fits, followed by heat of the skin, thirst, loaded tongue, loss of appetite, constipated bowels, and a full, hard, and rapid pulse. As the disease advances, the local symptoms, with the temperature of the skin diminish, and restlessness, prostration of strength, and depres-

sion of spirits supervene; the hue becomes pale, leaden, or yellow-
ish, the eye dull, and the countenance expressive of great anxiety,
without the patient's being able to refer it to any particular cause.
In the later stages, the skin, previously hot and dry, is moistened
with a clammy sweat; the extremities grow cold, the eyes hollow,
the features contracted, pinched, and haggard, the speech difficult,
the respiration laborious, accompanied by a feeling of weight in
the præcordium, and the patient lies prostrate in bed, frequently
sighing and moaning.   In some cases, painful paroxysms of cough-
ing occur; the pulse becomes more rapid, small, soft, and often
irregular; the wound in the vein assumes a withered, flabby aspect;
the purulent secretion is diminished in quantity, and becomes more
limpid and fetid, and the loaded tongue, at first white, becomes
dry and brown.   In some cases sickness and vomiting distress the
patient; in others severe purging exhausts him.   This form of the
disease is accompanied by laborious and frequent respirations, by
an icteric colouring of the integuments, great prostration of strength,
and sudden wasting of the flesh.

Along with these local and constitutional symptoms, others fre-
quently occur, indicating inflammation of important viscera; such as
the arachnoid membrane, which is marked by pain in the head, irrita-
bility, irregular though voluntary movements of different parts of the
body, and embarrassment of speech.   These symptoms are often fol-
lowed by exhaustion, incoherence of ideas, and sometimes stupor and
muttering delirium, from which, however, the patient can be roused.
Frequently there is a continual trembling or convulsive movement
of the thoracic extremities, with great debility of particular parts,
more especially of one limb.   In some patients, pain and swelling
occurs of the cellular tissue in different parts of the body, and con-
siderable deposits of pus take place.   In others, inflammation of
the serous membranes of the chest or abdomen occurs, indicated by
the stethoscope, and by a sense of pain in the part, more especially
in attempting a deep inspiration; or, in the case of the abdomen,
on the application of pressure.   In these last instances, great care
is requisite in the examination, and great judgment and experience
in the appreciation of the different symptoms, in order to arrive at
a true diagnosis.

In some patients vague, though severe pain, is felt in the muscles
of different parts of the body, or in the larger joints, which are

very sensitive, and collections of matter form without any external redness.

After lasting, in general, for a very considerable time, the acute stage of the local and constitutional affections terminate, leaving the patient exhausted, but for the most part free from pain. He now complains only of great debility, which seems to be the result of the extent and severity of the internal inflammation. He is sometimes much dejected, presaging, with apparent indifference, his approaching dissolution. Sometimes he falls into an unrefreshing sleep, during which he is continually muttering, but when roused appears sensible. In this exhausted state he may remain to the twenty-third, or perhaps linger even to the thirty-first day, when he expires, often unexpectedly.

When phlebitis originates in the severe and continued irritation of a vein, as by the application of a ligature, and the constitution of the individual is unhealthy, and the season favourable to the development of the disease, its progress is much more rapid; which quickly becomes evident by the ghastly appearance of the sufferer's face, and the extreme prostration of strength, under which he soon sinks. In one case of this nature, the disease terminated fatally in two days after the ligature. The appearance found on dissection is represented in Fig. 6 (a and b). For several inches above the divided extremity of the vein, where it had been tied, it contained unattached consolidated portions of blood, mixed with false membrane and yellowish purulent fluid.

After amputation, careful examination is often necessary to ascertain the presence of phlebitis, as its indications are very apt to be confounded with those of the inflamed stump. Its existence in such cases may first be suspected from the occurrence of a shivering fit, with general symptoms of fever. On examining the limb, the suspicion is confirmed by the redness, sensibility, and cord-like swelling along the course of one or more of the veins divided in the operation. The recurrence of shivering fits, prostration of strength, yellowish, anxious face, signs of internal inflammation, muttering delirium, and other symptoms of the latter stage of phlebitis, mark the progress of the disease. The diagnosis, however, is difficult, as the practitioner is liable to confound the cause with the effect. Often, even after death, prejudices warp

the judgment, often preventing the true cause of the fatal result of operations from being discovered, or even surmised.

It has been already observed that inflammation of a vein extends to the surrounding cellular tissue. In the same manner inflammation of the cellular tissue may affect secondarily the neighbouring veins. In such cases, however, the smaller vessels only suffer, and dangerous consequences seldom follow. A similar action and reaction may be often observed between the veins and a serous membrane. When one of these is inflamed, and bleeding resorted to, phlebitis not unfrequently attacks the wounded vein, and great precaution should be taken to diminish the danger of such a disease.

There are some chronic forms of phlebitis to which the old and infirm are subject, which commence, like erysipelas, with great pain in the limbs, and terminate in gangrene of the extreme parts of the body, and in death. In one case in which I was consulted by a gentleman, who had had considerable inflammation of the arm after bleeding, I found the cellular tissue and the aponeurosis of the arm so thickened, with a contraction of the biceps muscle, as greatly to impede the movements of the arm. In this case it was a considerable time before the use of the arm was recovered.

A comparison of thirteen fatal cases of phlebitis, the course of which I carefully followed, gives an average of nearly sixteen days, in which the disease ran its deadly course. Of twelve of the patients in these cases—3 died before the 10th day; 5 died before the 20th; 3 died before the 30th; and 1 after the 30th day. In other cases which I have examined, the disease did not prove fatal till a later period. In the examples of phlebitis enumerated, the fatal termination appeared to result—1. From the extension of the inflammation to the heart and vessels, and its effects on the blood and nervous system. 2. From the effects of the morbid secretion on the circulation and internal organs. 3. From the influence of the disease on certain important internal organs.

CHAPTER II.

CAUSES OF PHLEBITIS. THESE CAUSES ARE PRE-DISPOSING AND EXCITING.

SECTION I.

Predisposing Causes.

1. *Size and situation of veins.*—A small vein is more subject to inflammation than large branches, and the superficial veins than the deep seated, as they generally convey more blood, and their tissue is more highly organized. Veins liable to sudden changes of size, as those of the female pelvis after parturition, are likewise predisposed to inflammation.

2. *Rate of circulation in veins.*—When the blood is propelled against its natural gravitation, and the vessels contain a larger relative proportion of blood, which advances slowly towards the heart, there is greater liability to inflammation. In the old and infirm, whose veins are not so well strengthened by muscular support, and in whom the action of the heart is weak, and the circulation retarded by the greater or less ossification of arteries, the predisposition from this cause is greater.

3. *Old wounds or diseases of veins.*—When a vein is thickened, or in a varicose state, or had been wounded, it is more easily inflamed.

4. *Certain diseases.*—More especially of an inflammatory nature, not only of the veins themselves, but of some other tissues, increase the tendency to phlebitis—such as erysipelas, diseases of the cellular, serous, and synovial membranes, probably from a similarity in their internal tissue to those of veins.

5. Peculiar states of the atmosphere, impure air, crowded hospitals, or other unhealthy situations.

SECTION II.

Exciting Causes.

The exciting causes most likely to produce phlebitis are—mechanical injuries, extensive abscesses, and inflammation of neighbouring parts.

1. *Phlebitis from mechanical injuries of veins.*—I have already mentioned *the wound made by th; lancet in phlebotomy,* as a frequent cause of phlebitis, in consequence of some peculiar state of the atmosphere, and condition of the system. Another mechanical cause, too much overlooked, which often produces phlebitis, *is the irritation of veins by ligatures applied to them in operations.* When a vein is divided in operating, aggregations of consolidated blood form at the nearest valves and in the collateral branches, which discharge their contents into the divided vein, which prove generally sufficient to prevent hemorrhage. Sometimes, however, a large collateral branch continues to pour in blood into the wounded vein, to arrest which a ligature is applied ; and phlebitis, resulting from this ligature, is one of the most frequent causes of the fatal result of operations. Phlebitis after operations may indeed be hastened or caused by a peculiar predisposition in the individual to the disease, or by inflammation extending from the wound to the vein ; but it seldom occurs without the concurrence of other causes, such as the irritation of a ligature. Surgeons are too apt to regard the application of ligatures to veins in operations simply as a necessary precaution, from which no evil need be apprehended. Amputations of the lower third of the thigh, or upper third of the leg, are more frequently fatal than those of the leg or arm ; and this result I have in many cases traced to phlebitis, caused by a ligature applied to prevent venous hemorrhage from the femoral veins, which in these cases are divided below large muscular branches, one of which passes over the sartorius muscle, and joins the femoral or the articular veins, which pass downward, and join the popliteal vein. I have found great advantage in the use, in these amputations, of a merely temporary ligature, aided by external pressure along the course of the femoral vein, so as to close the large superficial branch.

2. *Phlebitis from abscesses.*—Venous blood is continually changing in its course towards the heart, according as one branch of an artery may deposit a larger quantity of one of its principles, or as the substances which the absorbents remove from the cellular and other tissues. When inflammation has produced the formation of an abscess, the neighbouring parts exhibit considerable-sized vessels, which become tortuous, and suddenly contract in their size near the abscess to a minute canal for the conveyance of blood. A direct contact with the abscess is cut off

by a more condensed cellular substance, which remains unchanged, and into which the secretion from new blood-vessels takes place of plastic fibrin, which assumes a molecular and corpuscular form. So that if a suppurating surface is cleaned from hour to hour with a fine sponge, the liquid thus obtained is thin and clear, but in ten or twelve hours pus corpuscles are formed, which have a white and opaque appearance, like the surface which produces them. A similar change takes place when the pus is absorbed from such sacs by the corpuscles being broken down before being removed. The nature of this pus is not only modified in quantity and quality in certain cases, but likewise by the nature of the tissue, so that when pus is absorbed by a serous membrane, or the internal membrane of a vessel, which in many respects resemble each other, it is more liable to affect similar tissues in other parts of the body. When so considered, experience seems to prove a close resemblance between the internal membrane of a vessel, and a serous or synovial tissue.

The softening of the tissue is succeeded by the formation of a sacculated abscess, and the cause producing new vessels, and secreting pus, acts as an irritant, and a consolidation of blood takes place in the small vessels, and in some cases in the larger trunks, which prevents pus entering the general circulation, and a check is given to the progress of the disease. In other cases, from the severity of the cause, or weakness of the system, this usual barrier is not formed, and pus unchanged enters the system, producing dangerous typhoid fever, and inflaming the serous and synovial membranes. It is by a similar process that the venereal poison, after acting locally, is conveyed into the system, and from its peculiar properties affects, secondarily, the mucous and cutaneous tissues.

A case of extensive inflammation and copious suppuration, following a compound fracture of the leg, proceeded favourably for a fortnight after the injury, when the suppuration suddenly diminished, and became unhealthy. Pain was felt along the veins of the limb, which became swollen, followed by œdematous enlargement of the foot and ankle. This was succeeded by symptoms of pleuritis and typhoid fever, under which the patient died. In another case an abscess formed in a stump, two months after amputation. The suppuration, which for nine days was considerable, suddenly ceased, and was followed by typhoid symptoms, and death. In

z

both these cases extensive phlebitis was found in the limbs; and
in the latter, several large deposits of pus were found in the cellular
tissue, without any appearance of surrounding inflammation.   In
a third case, an extensive abscess formed after a fracture of the
pelvis, of which the patient died two months after the injury.   The
femoral veins were found filled with consolidated blood, portions of
which were broken down, and converted into a puriformed fluid.
The vena cava inferior had a red blush of inflammation on its in-
ternal surface, which was deeper in the left iliac vein.   The heart
was large and flabby, without any change in colour.

In these cases, phlebitis does not appear to have taken place
until the acute state of inflammation had been succeeded by exten-
sive suppuration; which was proved, in the last case, by a con-
siderable venous hemorrhage following the evacuation of the con-
tents of the abscess.   This could not have been the case had the
veins been inflamed at an earlier period, as they would then have
been rendered impervious by consolidated blood.

In several patients who died after lithotomy, I found the pelvic
veins inflamed from the wound made by the operation.   Similar
consequences have been found to follow attacks of erysipelas, whit-
low, and such like diseases.

3. *Phlebitis from the extension of local inflammation to the
neighbouring veins.*—Veins sometimes become inflamed by passing
through, or proceeding from, inflamed parts.   John Hunter tells us
that he " had seldom seen suppuration in any part supplied with
large veins, in which the appearance in their cavities had not been
evident after death.   When the inflammation was most violent,
the veins were most diseased; but the pus was most *laudable* the
nearer it was to the inflamed part, and as the vessel receded from
this part, it was mixed with coagulated (consolidated) blood."   The
tendency to inflammation is increased in the veins of the uterus
after parturition, when they suddenly become diminished, and the
blood retarded.   The predisposition to phlebitis is further increased
by the injury which these vessels, and other pelvic viscera sustain
at such times, by the absorption of morbid fluid, or the extension
of irritation from the inflamed surface of the uterus, promoted by
imprudences in diet, by exposure to cold, and by over-exertion.
In such cases, the fever rarely occurs till after the first week, when
I have found the uterus enlarged and inflamed, with the pelvic

veins tortuous, and filled with consolidated blood containing pus in several places.

In two cases the patients lived for a month or two after parturition, and died much reduced, and weakened by the fever. In one of these, the uterus was four times the natural size, and inflamed. The uterine veins were tortuous, and distended with consolidated blood, and in some parts softened and converted into a pultaceous matter. In both, the lower extremities were swollen by a collection of serum; the arachnoid membrane was opaque, and there was a considerable quantity of serum in the ventricles. Another patient was attacked by fever, and great pain and tenderness of the left thigh. On examination, the part was found hard and swollen, particularly along the course of the saphina major vein, which was tender, and had a cord-like feel. In this stage the disease was arrested by the usual local and general antiphlogistic remedies. Had it not been judiciously treated at the early period, it would, doubtless, have developed the other characteristic symptoms of phlegmasia dolens.

CHAPTER III.

DIAGNOSIS AND PROGNOSIS.

When the inflamed vein is superficial, the red streak and hard cord-like feel, with pain and swelling along its course, sufficiently indicate the presence of phlebitis. But in the case of deep-seated and internal veins, the diagnosis is more difficult. The injury and inflammation of the neighbouring tissue obscure the indications of the disease, and divert the attention from the real seat of the evil. Thus, the inflammation of the serous membrane resulting from phlebitis, is alone alluded to, and valuable time is lost in the vain endeavour to arrest the effect, while the cause is overlooked. This mistake must be carefully avoided, and means employed to diminish the phlebitis, which may be detected with moderate attention and care.

When the existence of phlebitis is ascertained, the *prognosis* must be very guarded. The stage of the disease at the time of discovery, the season, the previous treatment, the nature of the exciting causes, the constitution of the patient, the complication

and severity of the symptoms, the size and number of the veins affected, and their situation with reference to other vessels, must also be considered; and special care taken, when there are indications of internal inflammation, such as anxiety, prostration of strength, or other typhoid symptoms, to be very guarded in the prognosis.

CHAPTER IV.

CONSEQUENCES OF PHLEBITIS AS THEY APPEAR ON DISSECTION.

These effects are either local, or distant from the influence of the disease on the system.

SECTION I.

Local effects of phlebitis are either on the blood of the vessel, or on its tissue.

a. Blood acts on its vessels by its quantity and quality   In young persons, when the blood performs such an important office in the growth of the body, the arterial system is active; as the body advances towards the adult state, the pulse becomes less frequent; and in old age, when the blood performs a less active office, it becomes slower in its circulation through the body.

The blood remains homogeneous from the left side of the heart to the extremities of the arteries; where it undergoes continual changes by the vital action of the arteries secreting, and by the quantity of the fluid absorbed. These changes in the quality of the blood modifies its action on the part. When the quantity of the blood is increased, and the crassamentum augmented, it produces the state of the body called plethora; and when the action of the part is increased in a high degree, it becomes morbid, and the functions of the part are deranged. Numerous irritating causes produce this local congestion of blood, which terminates in symptoms named inflammation.

A fluid like the blood, which forms such a large proportion of the body, and performs such important offices in the animal economy, deserves the best attention of the pathologist; but although the knowledge of disease has been so much advanced by their labours, the blood, which is the medium through which the

body is nourished, and new parts built up, has often received little attention, from being considered as an inorganic body, and incapable of participating in its diseases, although it is by its vitality alone that we can explain the changes it undergoes in different states of the system. These changes are often very considerable, affecting the quantity and quality of that fluid in the same person, in different situations, and at different times in health, and when affected by disease.

This conclusion is proved by observing the changes produced by inflammation on the large veins when the vessel is superficial. One of the first symptoms observed is a hard cord-like substance along the course of the vein, which is proved on dissection to be produced by a consolidation of its contents. This change in the blood is constant, and seems to be produced by an increased degree of that alteration which is observed when the system is strong, and consolidates the blood in the vessel. This change is the effect of a higher and morbid state of vitality in an inflamed vein. In the same manner the vital principle of the vessel and its contents act on each other, and produce the diversity of fluids in the system. The same sympathy between the vessel and contents produces a reciprocal action on each other, when either are affected with disease ; thus, when an irritating cause is applied to a vein, it first affects its tissue and then its contents, which again act on the vessel. It is these effects of irritation which produce a red streak or blush along the course of the vessel, and a consolidation of blood, which retards the advancement of the disease to the vital organs, and prevents the introduction of pus directly into the system; as in Figs. 1 and 3, in which the pus was prevented getting directly into the circulation, but, by the advancement of the disease, hastened the fatal result.

This state of the morbid parts has led some to suppose the disease was stopped; and the consolidation of blood separated the diseased from the healthy part of the vessel. Such a supposition is unphysiological, as vessels and their contents have always an intimate sympathy. This was beautifully proved by the preparation from which the third drawing was taken, in which the vessel was filled up with consolidated blood at g, h, and e, and still the inflammation extended beyond this to a, where the coat was thickened, and plasma thrown out upon its surface.

That the red streak and consolidation of blood are the effect of the irritation, is proved by their disappearing; when the exciting causes are removed, or energetic antiphlogistic remedies early applied; when the vessel becomes pervious, and the part is restored to its natural state. This forms the termination of phlebitis by resolution.

As the inflamed veins become impervious by the consolidation of blood, absorption of the serum in the cellular substance from which such veins arise, is retarded, and its accumulation forms an œdematous swelling along the course of the diseased veins. When the inflammation is more acute, more plasma is effused, and a hard swelling is the consequence; when still more severe, pus forms. In some cases, when the constitution is weak, and the cause severe or long continued, the consolidation of blood in the vessels of particular parts is so general that the part becomes gangrenous, from want of circulation.

When consolidated blood in the vein does not again become liquid, and the inflammation is severe, it undergoes other changes; the red globules become fewer at the centre, and at length disappear, leaving a hard white substance, which softens, and terminates in a puriformed matter. The external crust of consolidated blood remains longer unchanged, and becoming thinner and united to the internal surface of the vein; with an irregular internal surface of a pale colour, which contains pus, and has been improperly supposed to be a false membrane.

When veins in this diseased state are carefully examined, it will be generally found that at different distances its tissue is thickened, and its caliber reduced in size; in consequence of the disease slowly advancing from one part to another, consolidating the blood as it advances, while that which was before changed becomes pus. At these contracted points nature had made an effort to stop the progress of the disease by consolidating portions of blood, while the intermediate portions of the vessel were increased in size; and, should the patient live long enough, pus forms and tends outwards, producing separate abscesses; as occurred a, Fig. 1.

These changes are well seen in the following experiment. Dr. Mackenzie exposed the jugular vein of a dog, and ligatured several veins entering it. An opening was then made in one of the branches, and a solution of the nitrate of silver passed into its

interior upon lint, and applied to an inch and a half of lining membrane. The dog was killed 16 hours after the application. On dissection, the wound was found inflamed and thickened, and a firm "coagulum" was found to occupy the interior of the vein to the extent of the irritation. The "coagulum" was uniformly of a dark colour, and adhered to its upper and lower extremities. The internal membrane was slightly reddened and discoloured; its coats thickened and opaque. These morbid changes terminated abruptly, and the vein was elsewhere healthy.*

Such changes in the blood are quite different, as we have seen in the first part of this essay, from coagulation, which properly designates the chemical changes which the blood undergoes when removed from the body. The former is a vital process, of which the following is an example :—A person received a wound in the ham from the kick of a horse. The saphina vein hung out from the wound, and continued to bleed. I tied a ligature (at a, Fig. 4) so as to produce a certain degree of irritation in the part, which was followed, some hours afterwards, by a consolidation of blood in the vessel (at b). The desired effect having been produced, I cut off a portion of the vessel, including the ligature ; near which the coats of the vein (at c) were thickened, and the consolidated blood was dark and homogeneous, and very different from a coagulum. The same effect is illustrated by Figures 1 and 2. In the former b, c, d represent such a changed portion of blood ; and in the latter at c. The consolidated blood is the adhesive stage of inflammation, and with the thickened coats of the vein, particularly of the cellular tissue, forms a barrier to the spread of inflammation in the vein, and prevents morbid fluids from being poured directly into the circulation. As the inflammation advances, vital changes take place in the consolidated blood, which in some cases softens and breaks down under the severity of the cause, as is seen in Fig. 1 at c, taken from a case when the vein was filled with purulent matter. In this case, and in Fig. 2, the suppuration did not extend beyond a few inches. Little pus had formed, and still less seemed to have got directly into the circulation, as both were bounded by consolidated portions of blood ; yet severe and fatal internal inflammation of serous membranes occurred. Such consequences did not

* Vol. 36, Med. Chirurg. Trans., read 8th March 1853.

take place in cases where the consolidation of blood was more extensive, the surrounding cellular tissue more severely affected, and the tissue of the vein thickened ; all indicating a more chronic form of the disease.   In such cases, the secondary or internal consequences are not so liable to occur, just as diseased joints may receive with impunity injuries which, in the case of healthy joints, might be attended with severe, if not fatal results, resembling very much those following phlebitis.   In the cases from which the first drawing was taken, phlebitis was produced by venesection ; and although the extent of the local disease was small, being bounded by the consolidated blood at *d,* the tissue of the vessel and surrounding cellular tissue at *e* remained unchanged, such an irritation was produced in the system as to cause violent inflammation of serous and synovial membranes, rapidly followed by fatal consequences.   When the system is not sufficiently strong, or the irritation is so severe as that of a ligature (in Fig. 6), the inflammation passes to suppuration before a sufficient quantity of consolidated blood forms the barrier to prevent the entrance of purulent matter into the system, inflaming the heart, large vessels, or one or more serous membranes, according to the particular predisposition of the individual, accompanied by fever of a typhoid nature, which soon terminates in death.

A more careful examination of the appearance of inflamed veins on dissection exhibits the blood consolidated, from a vital union of its red corpuscles, accompanied by an inspissation of the plasma, as regards its albuminous and fibrinous constituents.   When examined by the microscope, the dark colour of the consolidated blood is found to depend upon an infinity of red disks, mingled with fibrinous globules.   The firmness being due to the advanced organization of the fibrin ; and fibrinous cells are found in all stages, from the granulated sphere to the caudated cell, developing into filamentous tissue.   In others, the nuclei had nearly disappeared, and the filaments clear ; while the cells appeared drawn out into filamentous prolongations at either end, and by their interlacement, the firmness and definite outline of consolidated blood became due, and precedes the true progressive organization of living germs, or the formation of new vessels within the mass.   This law of vitality is often impressed upon the cell germs, even when all direct con-

nection with living tissue had ceased.* The inherent vitality increases, and it becomes organized by the formation of new vessels in its substance, which connect themselves with those of the surrounding tissue. Such organized portions of blood, as we have already seen, p. 60, are called *polypi.* When such a consolidated portion of blood fills up a vein, the circulation is left languid, and when there are numerous collateral vessels, the red globules are slowly removed, and the pale substance left becomes hard and tough like cartilage. In the case of a woman who died some time after delivery, the veins of the uterus were found large and tortuous, and the consolidated blood they contained had assumed a cartilaginous hardness. In another case, the patient seemed to have lived longer after the consolidation of blood; and in the centre of the hard cartilaginous degeneration, calculi or *phlebolites* were found. These small rounded osseous-looking bodies have been described by Beclard in his *Anatomie Générale,* and by Cruveilhier, and Jules Cloquet, in his excellent work on *Pathologie Chirurgical;* and although they produce no bad effects on the part or the system, they are of considerable physiological importance, as strengthening and confirming the above opinions on the nature of the blood.

Beclard and Cloquet describe them as being most frequently enclosed in layers of fibrous matter, or coagulated blood; but when they are smaller in veins, subject to great changes in their size, we can understand how that excellent physiologist, the late Dr. Reid; alas! too soon removed from the scene of his labours, should find them without any covering whatever.† Cloquet found the smaller ones formed in a little soft clot, or consolidation of blood; those of a large size contained in the centre a nucleus of white fibrinous matter, and the largest had in their centres an osseous-looking nucleus, upon which the white fibrous matter was arranged in concentric layers, the internal very hard, and the other becoming gradually softer as they approached the surface. He has likewise given a drawing of a round fibrinous mass taken from the vena cava inferior, containing an ossific-looking matter in the centre, from which a number of rays of the same substance passed through the fibrous matter towards the circumference. Another specimen

* See Dalrymple on the Early Organization of Coagula.—Med. Ch. Tr., London, v. 27, p. 10. † Research, p. 394.

similar to this was seen by Cloquet in Sœmmering's Museum. *Hodgson** supposed they were first formed external to the veins, and *Andral*† believed they were in general first developed in the middle coat of the veins, and then passed into their interior in the same manner as the false cartilages are formed, and pass into the cavity of joints. Tiedemann,‡ Otto,§ Lobstein,‖ Cloquet,¶ Carsewell,** and Mr. Langstaff,†† were inclined to believe that they are formed in the interior of veins; and Tiedemann, Lobstein, and Dr. Reid‡‡ seem to favour the notice of their being merely depositions from the blood, as urinary calculi are from the urine; while the nature of their formation, the gradual conversion of the fibrinous layers into an osseous substance, the radiation of the ossific matter through the fibrous clots, and their chemical composition, must strongly incline us to ascribe their origin to something more than ordinary physical or chemical laws. In his collected essays, Reid states§§ " that the formation is probably akin to the occasional hardening of tubercles into bony concretions, which is a process independent of any vascular organization of the tubercles themselves," and " supposes they are the result of a process resembling the formation of the osseous bones with the other parts of the body." In my essay on Phlebitis, printed in 1831, I expressed the same opinion. " Such calculi are produced by gradual changes in the consolidated blood, to a cartilaginous, and afterwards into an osseous substance called *Phlebolites.* Such changes may be frequently seen in its different stages to the osseous state, in cases of old aneurisms. These phlebolites have an ovoid form, are found of all sizes, from the head of a pin to that of a pea or bean, and have commonly a smooth surface. The smaller ones are found unattached to the veins, and are generally surrounded by consolidated blood (see Fig. 8). The larger phlebolites are found in the splenic veins, and have more irregular surfaces than the others. These calculi are of a light-yellowish colour, generally mixed with red blood externally (see Fig. 8, *b*), which allows the circulation to proceed. They are formed of concentric layers, their specific

* Treatise of Dis. of Arteries, p. 521.   † Anatomie Pathologique, t. 2, p. 412.
‡ Journal Comp. du Diction. des Sciences Med. t. 3.
§ Path. Anat. Trans. by South.   ‖ Anat. Patholo.   ¶ Path. Chirurgical.
** Cyclop. of Practical Medicine, art. Veins.
†† London Med. Chirurgical Transactions, vol. 8, p. 287.
‡‡ Pathological Researches, 1848, p. 395.   §§ Loc. cit. p. 398.

gravity is near that of bone, and their hardness increases when taken out of the body and dried." *

In some cases, when coagula have filled up the veins, the blood does not circulate through the branch, which contracts, and often becomes obliterated, leaving the calculi in what is erroneously supposed to be cellular substance. In other bodies the veins are left impervious after attacks of phlebitis, and the circulation is carried on by collateral branches; or the consolidated blood may disappear, and the thickened vein, now reduced much in size, allows a smaller stream of blood to pass through it.

b. Changes produced on the tissue of inflamed veins as they appear on dissection. When a venous branch is divided across, it is slowly obliterated, and disappears in the surrounding cellular tissue by a process commencing by the vein retracting and contracting, and by more or less consolidated blood from the cut extremity to the next collateral branch which pours its blood into it, assisted by the slow absorption of the consolidated blood, and by the shrivelling of the vessel and neighbouring parts. When a wound in a vein is not healed up in the usual manner, by the formation of consolidated blood between its lips; but, from the peculiar circumstances of increased susceptibility to inflammation, it becomes of importance to decide on the presence or absence of this state before death, from the appearances on dissection. Redness of a surface, as we have already seen, although one of the most characteristic signs, does not alone prove that inflammation had been present in a part before death. This is particularly the case with respect to the inflammation of veins, as various causes before, as well as after death, produce this appearance. Thus, in some cases of great debility, and in some diseases of the heart producing a mechanical obstruction to the return of the blood, congestions are produced, giving a red appearance to the tissue of the vessels. Sometimes the internal surface having this colour depends on imbibing from the blood remaining liquid in the part, or from the tissue of the vein being of a softer and more spongy texture than natural; or becoming so when the tissue has arrived at a certain stage of putrefaction. That this is the proper explanation of the redness of veins may be proved by removing pieces of these vessels belonging to different bodies, and filling

* See also Pathology of the Blood and its Containing Vessels. Calcutta Medical Journal for 1834, p. 20.

them with semi-liquid blood. The internal surface of some of these portions of vessels will be found changed to a red colour, while others will take a longer time; but in all, redness is produced as the state of putrefaction advances in the tissue of the vessels.

I examined, in the month of November, the body of a plethoric individual, fifteen hours after death, who had died of apoplexy produced by an organic disease in the heart. The vessels, particularly the veins, were gorged with liquid blood. The coats of the arteries were red, especially where they touched their accompanying veins, while patches were of the natural colour. The internal surface of the veins had their natural shining appearance, and was of a red colour, which could not be entirely removed by washing. The redness became more florid, after being exposed for some time to the air. In this case there was no appearance of putrefaction to explain the occurrence of redness, nor did it appear to be the effect of inflammation, as there was no change in the tissue of the vessel, nor of its contents, to explain it; but it was produced by congestion. This may be distinguished from the redness of inflammation, by its dark chocolate colour becoming florid, when it has been exposed to the air for some time, and by its being removed in a great degree by washing.

The natural shining appearance of the internal surface of the vein continues unaffected, and may become red from the increased vascularity of the neighbouring cellular tissue, in which the morbid changes take place.

It is only in very acute, or protracted cases, that the internal tissue of large veins, when there has been no consolidation of blood, has an inflammatory flush on its surface. In one case of phlebitis, I found the internal surface of the vena cava red and inflamed. Mr. Lawrence, in another, found the præcordium highly inflamed, and the increased redness, with patches of ecchymosis, particularly evident in the left cavities of the heart. In such cases the serous membrane was found smooth, and unchanged, the muscular substance of the heart softened, and partially broken down; while yellow pus was effused into the broken textures, but not collected into an abscess.*

In some cases of phlebitis, the cellular tissue around and destid

* Med. Chirurg. Transactions, vol. xv. p. 127.

of the inflamed vein is found thickened or infiltered with serum ; and in some places, often at a distance from the local disease, containing deposits of a puriform matter. In several of the fatal cases of phlebitis, I found the lungs and liver inflamed, and studded with abscesses. The arachnoid membrane was often found opaque, with serum under it, and a larger quantity than usual in the ventricles of the brain. The pleura and peritoneum were thickened and opaque, with an effusion of serum into their cavities, and portions of pultaceous matter upon their surfaces. In other cases, the synovial membrane, especially of the knee-joint, was found thickened and inflamed, and sometimes the articular surfaces partially ulcerated.

The internal tissue remains for a certain time unchanged, when the vessel is filled up with consolidated blood ; and it is when the cause is acute and continued, that the redness of the cellular tissue, and a deposit of lymph takes place upon the internal surface of the vein.

It will be necessary, therefore, before we can decide whether inflammation has been present during life, by the appearance on dissection, to appreciate the effects of the above causes. It will be of advantage to know the history of the case, to examine the vein as soon as possible after death, to remark if there be any considerable portions of blood, and to observe the degree, extent, and uniformity of any redness there may be in the trunks of the veins leading from the part, and the changes produced on it by washing, and exposure to the air. Should the tissue of the vein have deposits upon its internal surface, be soft and easily torn, the valves opaque or ulcerated, or any puriformed deposits on its surface, we may pronounce, without hesitation, that inflammation of the vessel had existed before death.

When phlebitis has continued for some time, the consolidated blood becomes connected with the tissue of the vein ; this happens more particularly at certain parts where nature seems to make an effort to stop the progress of the disease, by secreting lymph into the tissue of the vein so as to thicken its coats, contracting the caliber of the vessel, and uniting it intimately to the condensed blood. (See Figs. 1 and 3.) In this manner, there is a boundary formed between the healthy and diseased portion of the vessel. This is subject to some modifications, from being quickened or retarded in its progress by different individual circumstances. In some uncommon cases, the inflammation

seems to be confined longer than usual to the tissue of the vein before affecting its contents, the internal membrane of the vein becomes soft, and can be easily torn, is opaque, irregular in its surface, and contracted in its caliber, from the deposit of lymph upon its surface, although the structure of the tissue remains the same. A beautiful example of such a case is delineated in Figure 3, where the coat of the vessel is thickened at *b*, lymph thrown out at *a*, and a contraction of the caliber of the vessel, producing the puckered appearance represented at *c*. The effusion of lymph, and contraction of its caliber, might have obliterated the vein, had it been small, as sometimes happened where lymph alone seemed to form the boundary. This I have only seen in one instance ; and it must be very rare, as it can only happen when the vessel is small and impervious, and its tunics affected with a certain degree of inflammation.

The difficulty with which the internal membrane of veins takes on this form of adhesive inflammation, is the cause of the dangerous consequences which so frequently follow phlebitis. The inflammation has therefore more the character of the symptomatic class, which is diffuse, and changeable in its situation, and accompanied with less swelling ; unless when it extends to the neighbouring cellular tissue, when the symptoms are acute. If it be confined to the tissue of the vein, the disease is more chronic, the constitution sooner affected, and it quickly terminates in the typhoid symptoms.

The following case is interesting, as affording a good example of the usual changes found in the tissue of an inflamed vein after death :—

I found, in the dissecting room of La Pitié, Paris, the body of a muscular man, who had had his leg amputated some time before he died. All the splanchnic cavities of the body had been opened without discovering any cause for the patient's death. The veins had not been exposed, and expecting to find them diseased, I proceeded to examine them. On opening the vena cava ascendens, I found its internal surface of a dark uniform red colour, containing several portions of consolidated blood. Eight inches from the termination of the vein in the stump, two valves were situated, which appeared more opaque than natural. The internal membrane was irregular in its surface, and easily torn. Two other valves appeared to have been removed by ulceration, and only irregular semicircular prominences were left. The internal membrane, from this point

to its divided extremity, was thickened, irregular, and filled with pus. Its internal surface was of a light colour, and rough at different parts from the deposit of unadhering lymph, which, when removed, left the shining transparent appearance of the internal surface of the vessel. In such acute cases of phlebitis, the irritation of the diseased vein is conveyed along the tissue, and the purulent secretion from its surface passes into the circulation, inflaming the heart and large vessels, and one or more of the serous membranes, according to the predisposition of the individual. In such cases, on dissection, the effects of the inflammation may be traced to the heart and large vessels. On examining the diseased veins, portions of consolidated blood will be found, as in Fig. 6, not sufficient to form the boundary to prevent the pus from passing into the circulation ; and even when the consolidated blood is more complete, the irritation may lead to the fatal termination, as occurred in Figs. 1 and 3.

SECTION II.

Effects of Phlebitis upon distant parts of the body.

We have seen that in fatal cases of phlebitis, the local acute symptoms diminish after some days, followed by more or less marked rigors, a low feverish state, with a rapid variable pulse, hot skin, and icteric hue of the surface, great anxiety, and prostration of strength. In some cases the patient complains of great feverish anxiety, of pains in his limbs, or in particular joints ; in other cases, the breathing becomes laborious and hurried, the pulse small, rapid, and irregular, the countenance dark and unhealthy, with sudden swellings and effusions in joints, or in the subcutaneous cellular tissue, without any assignable cause, and typhoid symptoms, and death terminates his sufferings.

On examining the bodies of such patients, besides the local appearances of phlebitis, evidence of recent acute inflammation is found in several internal tissues and organs. The cellular subcutaneous tissue, the synovial membrane of joints, and the serous tissue of the head, thorax, and abdomen, with an effusion of loose coagulable lymph and pus, and inflammatory appearances of the liver and lungs, which are often studded with abscesses. These appearances are explained by the pus, like the blood corpuscles, being disintegrated by a reduction of the inflammatory irritation which had caused the secretion. This may be hastened by the external application of iodine, by blisters, the nitrate of silver, and such like

irritants, over the su puration. The pus corpuscles are thus resolved into their molecular and fluid elements, and by the law of endosmose, removed from the serous or cellular substance, in some cases to be secreted into analogous tissues, in other parts of the body.

CHAPTER V.

TREATMENT.

Before considering the means of curing phlebitis, a few suggestions may be premised for the prevention of so dangerous a disease.

The exciting causes should be carefully avoided, particularly in the case of persons and veins predisposed to such inflammation. Wounds, and the irritation of veins by other causes, should be guarded against. During operations, the effect of taking deep inspirations, and by the application of cold and of pressure upon the bleeding veins, and along their course, will be found, in a large proportion of cases, sufficient to arrest venous hemorrhage, and will preclude the necessity of applying a ligature to the vessel. When this is indispensable, it should, as already observed, be a broad or flat one, and applied only with tightness sufficient to bring the sides of the vein together, and in such a manner as to admit of its speedy removal. In bleeding, the practitioner should take care that his lancet is sharp and clean, that the wound is of the proper size, that the bandage is properly applied, and kept on for twelve or sixteen hours, for the healing of the wound, which must not be irritated by the movements of the arm, by the kind of pledget employed, or by friction. Whenever any uneasiness is felt in the part, or redness appears on the lips of the wound or its neighbourhood, the bandage should be removed as unnecessary, and now highly dangerous, by increasing the tendency to phlebitis.

Phlebitis ought always to be regarded as a local disease of the most dangerous nature, and the first endeavour should be, by the energetic employment of local remedies, to arrest constitutional consequences. The patient, if plethoric, may be bled from the opposite arm, to produce a marked effect on the system. A number of leeches may then be applied along the course of the inflamed vein, and after they have dropped off, the bleeding encouraged by fomentations. When it has ceased, anodyne fomenta-

tions and poultices, with Goulard's lotion, should be applied to the inflamed part, hot or cold, according to the feeling of the patient. In all such cases a narrow bandage ought to be applied round the member above the seat of the disease, and kept wet with a cold evaporating lotion, which will aid powerfully. in keeping down the temperature of the limb. Aperients are at the same time to be exhibited, with repeated doses of diaphoretics, sufficient to produce their full effect. In two cases I found half-grain dozes of tartar-emetic, repeated every half hour, attended with marked benefit.

When the member is much swollen, red, and painful, incisions through the inflamed cellular tissue will be found of great use in removing the tension, diminishing inflammation by emptying the vessels of the part, and giving vent to any pus that may be formed. Where pus has collected in the vein itself, much benefit will be obtained by following Surgeon Bond's method of introducing a director into the wound in the veins, when superficial, and with a probe-pointed bistoury enlarging the opening upwards—proximid.* In such cases it is of importance to avoid removing the consolidated blood, which will regulate the extent of the vein to be exposed. The pus is to be carefully removed from the vein, and the wound healed by fomentations and poultices. By this means the character of the dangerous inflammation is changed, and the pus being dis-charged, the fatal secondary symptoms, caused by the absorption of pus, and the extension of the irritation to internal organs, pre-vented.

When considering the dangerous operations for the cure of varicose veins, a case will be related in which the veins were exten-sively inflamed, and were freely cut into, to evacuate the pus (see page 353). One of the incisions into the veins was four inches long, and this free exit to the pus probably saved the patient's life. In this case poultices and fomentations were used to heal the wound.

When the constitutional symptoms have developed themselves, with indications of internal inflammation and derangement of the liver, I found small doses of calomel of much use; such as a sixth of a grain, with a little antimony and magnesia, or chalk, repeated every hour, so as to affect the system. This is accomplished in a mild but efficacious manner in from twelve to fifteen or twenty hours.

* Medical Reports of the Madras Medical Board for 1832, p. 271.

2 A

In the typhoid, or low stage of the disease, great attention should be paid to airing the ward, and diffusible stimulants may be exhibited with advantage, so as to impart a preternatural energy, which may resist and extinguish the diseased action.

CHAPTER VI.

CHRONIC PHLEBITIS.

The circulation of blood in veins is produced by the force with which the arterial blood is sent from the heart, assisted by the elasticity of the vessels, by the contractions of the neighbouring parts, and by the tendency towards a vacuum produced in the chest during expiration; while a retrograde movement of blood in veins is prevented by their frequent anastomosis, by the large capacity of the veins over the arteries, and by the valves. But there are other causes which often impede the circulation in those branches of veins which are sometimes increased in length and size, such as a natural weakness, particularly as age advances, or from the blood moving against its own gravity. Other veins have an unusual quantity of blood sent to them from the pressure of distended organs, as of the uterus, colon, &c., or from branches of veins being partially obstructed by their position, or exposed situation, as of the deep veins of the leg during the action of the muscles in standing, around old ulcers, cancerous tumours, &c.

As the effects of inflammation on the blood has been already considered, I shall confine the following remarks to the influence of chronic inflammation on the tissue of veins in general, and on the production of a varicose state of the veins.

SECTION I.

Effects of Chronic Inflammation on the Tissue of Veins.

In old age the action of the heart is weaker, and the veins are more distended than in the young; and this accumulation of blood in veins, enlarges their anastomosing branches, and this local irritation produces an increased vascularity and thickening of their tissue, until it is able to resist the further influx of blood. In this thickened state the vein loses its elasticity, particu-

larly where it is weakest, and least supported by neighbouring parts. This enlargement and thickening does not take place uniformly, but according as the influence of the blood affects the part, from its position, the situation of its valves, &c., which affords more or less resistance to the accumulation of the blood. At one place the tissue of the vein becomes thickened, and is sometimes converted into a substance like cartilage and bone, whilst at other parts the coat of the vessel, from weakness, yields to the pressure of the blood, which, accumulating in the part, increases its length, gives it a tortuous, rounded figure, and where superficial, the dark venous blood may be seen through the skin and thin tissue of the vein at certain parts.

In a more chronic form of phlebitis, the fibrous coat of the vein thickens ; and other stimulants besides inflammation appear to produce this effect. M. Beclard found the femoral vein thickened, and its tissue containing a deposit of bone, from the influence of the arterial blood, as it was only at the part where the veins touched the arteries, that the hypertrophy was observed. M. Recherand* dissected a basilic vein which had had a communication with the artery forming a varicose aneurism, and had received arterial blood for eight years before. The tissue of the vein was thick, and of a yellowish colour, and had much the appearance of an artery ; while the artery which communicated with it was thin, and had a greyish appearance, like the veins. Mr. Wilson† found the veins much thickened in a woman who died of puerperal fever. Such changes are not of so rare occurrence as is generally supposed, and in some cases of inflammation the tunics of the veins are much increased in thickness and density, and the caliber of the vessel is so reduced as not to admit the passage of blood through some of them. Fatty tumours are sometimes formed in the tissue of the vein ; this, however, is of rare occurrence.

Chronic inflammation tends to produce hypertrophy of the tissue of veins, and by degrees it becomes changed into a cartilaginous substance, in which deposits of bone sometimes take place, without any change in the internal membrane. Such cases most frequently happen in old persons, when there is a natural disposition to the formation of bone. In the Ephemerides des

---

* Histoire des Progress Recents de la Chirurgie, p. 116 ; Larrey, Bullet. de la Fac. de Med., Paris, 1812. † Transactions of a Society, vol. i. p. 134.

Curieux de la Nature* a case is mentioned, in which the veins of the heart were ossified. The sinus of vena porta is sometimes partially ossified; I saw a beautiful specimen of this in the museum of the University at Strasburgh;† Morgagni‡ found in one case the inferior vena cava cartilaginous and ossified; in another he found the renal veins in the same state. Murray observed many spiculi of bone in the crural, as far as the popliteal vein. Professor Cruveilhier§ found in the body of an old man who died from gangrene, accompanied with extensive ossifications of the arteries, the popliteal veins partially ossified. Dr. Macartney found the external saphena vein containing pieces of bone ; and I found considerable portions of osseous deposit in a branch of the saphena major, which was in a varicose state.

<div align="center">SECTION II.</div>

<div align="center">*Varix or Varicose Veins.*</div>

When the inflammation of a vein is chronic, affecting particularly the tissue of the vein, it becomes dense, thick, and fibrous, and adheres closely to the neighbouring parts. In some cases of this kind, the vein has the appearance of an artery; and when the disease had long existed the vein is left very irregular in its internal surface, from the unequal pressure of the blood distending the weakest parts, and often rupturing the valves, while the interstices increase in strength, and have transverse prominences, which I have seen forming bands like the columnæ carneæ of the heart.

This varicose state of veins is a very common and often distressing complaint, producing the morbid enlargement and thickening of the veins from chronic inflammation. The person's attention is first directed to the part by a dull, heavy pain, from the distension and weight of the vein, with a degree of tenderness and pain in particular swollen parts of the vessel. When the veins of the legs are affected, the symptoms are aggravated in particular positions of the limb pressing on the tender part, when in a dependent position, and the vessels turgid with blood. As the

<div align="center">* Dec. iv. an. 10, obs. 175.
† See likewise Ruysche Thes. an. viii. ob. 58 et 70.
‡ Epist. 54, art. 9.   See also Baillie's works by Wardrop, vol. i. p. 42.
§ Essai sur l'Anatomie Pathologique, tom. ii. p. 70.</div>

obstruction continues, the circulation becomes more difficult; the veins become more extensively diseased, and the symptoms more aggravated. The branches of veins which are most liable to the disease are those of a weak, plethoric constitution, or in old age, particularly where the blood flows against its own gravity, and the valves are few, or ruptured; where the continual action of muscles of progression propels an unusual quantity of blood to the superficial veins; where the heart has little influence upon the blood, and where the vessels are imperfectly supported by the neighbouring parts. By such causes the quantity of blood is increased in particular vessels beyond their strength, and they become permanently enlarged, and a varicose state of the veins is produced. This explains their frequency in the legs of old persons, and in the hemorrhoidal, spermatic, and azygos veins. When they occur in other parts it is usually from some mechanical impediment to the return of the blood from the heart and lungs; by aneurism of the aorta; by an ossification of the valves of the heart; by ligatures, such as garters round the leg; by the pressure of the gravid uterus; by diseases of the liver, and other abdominal viscera; by prolapsis ani; and sometimes by a weakness in the tissue of the vessel from injuries or causes that increase the quantity of blood in veins, which may act as the exciting cause of their varicose condition.

In this state of enlargement and thickening, the veins are always most liable to inflammation; the exciting causes of which must be carefully guarded against. For a like reason, parts at a distance from the heart, where the blood returns slowly, and against its own gravity, are always more subject to ulceration. It is for this reason the inferior extremities of tall people are more subject to them, particularly in persons having old varicose veins; and under such circumstances the ulcers are difficult to cure. For this purpose the limb should be kept in a horizontal position, and the diseased vein supported. These ulcers are indolent, and are accompanied with considerable pain along the varicose vein, which is increased by long standing, and are very distressing and difficult to cure, particularly where they occur in a person who is obliged to stand much, and depends for subsistence on his own exertions. Hemorrhage often takes place from the rupture of the veins, and being repressed with difficulty, large quantities of blood may be lost without producing much effect on the system, in consequence of so much of

the venous blood in the part remaining nearly stagnant in the venous plexus, and in some degree out of the circulation. In such patients the application of equable pressure and styptics will be sufficient to check such hemorrhage ; but in some cases more distressing consequences occur : A young man was admitted into hospital with a large oval-shaped ulcer on the dorsum of the foot, with a hard prominent margin, which exposed the tarsal bone. It had been neglected, and by walking about it was inflamed, and the varicose veins were tender. The patient was emaciated, and the lungs much affected. Soon after admission into hospital hemorrhage took place from the ulcer, and a considerable loss of blood was sustained before it was arrested, by the application of the actual cautery. In his weak state, the loss of blood hastened the fatal termination. The lungs, on dissection, were found extensively diseased ; the tarsal bones in a state of caries, and the ankle-joint opened. The deep-seated veins of the leg were found distended with consolidated blood, from the femoral downwards, and increased the tendency to ulceration. On dividing this consolidated blood, the centre had a light colour like lymph. A large artery opened on the ulcer, from which the hemorrhage had proceeded.

A varicose vein is usually slow in enlarging, and is often accompanied by a numbness, heaviness, or unsettled pain in the part. These symptoms appear to be owing to the higher state of organization, and the tendency to chronic inflammation of the varicose veins, which are the cause of their being liable to burst; of their contents being consistent, of a dark colour, and in general partially converted into condensed blood. When any irritating cause is applied to a vein thus predisposed, phlebitis not unfrequently follows. This may be only in such a degree as to produce a consolidation of its contents, and a swelling of the part which declines, when the exciting cause is diminished or removed, and the vessel again becomes pervious to the circulating blood. When the inflammation is more chronic, the collateral branches enlarge, and the inflamed vessel becomes obliterated. Should the phlebitis be acute, its usual symptoms occur ; the vein becomes distended, accompanied with a particularly painful sensation along the course of the vessel, which is tender to the touch. The neighbouring tissue of the vein, and those from which it principally arises, swell, and a

red blush of inflammation appears along the course of the principal inflamed veins. In more severe cases, when a greater number of small veins of the cellular tissue are affected, an œdematous state of the extremity or of the member occurs, producing phlegmonous erysipelas, accompanied with symptoms of inflammatory fever. In some of these cases the consolidated blood becomes converted into a puriformed matter, forming an abscess which opens externally. In other cases the inflammatory symptoms assume a typhoid character, and terminate fatally.

The varicose veins are so predisposed to inflammation, that frequently dangerous and even fatal consequences follow the operation employed to relieve the distressing consequences of this state of the vessel, by obliterating it. The kind of operation performed, and the precautions employed before and after it, will modify the event; but, when the varicose vein is in an irritable state, a trifling cause will generally hasten the fatal result; as is exemplified in the following case :—

Sarah Nichol, æt. 50, a corpulent woman of a full habit of body, and ruddy complexion, first observed the veins of her leg enlarged thirty years since, after a difficult labour, and have continued diseased since that time. She has experienced several attacks of inflammation, which on two occasions prevented her following the occupation of a chambermaid. These attacks soon yielded to rest and mild antiphlogistic means. For a week before, the varicose veins had been unusually large, knotted, and painful; for which leeches, lotions, and bandaging had been employed without much relief.

At the time of admission there were two considerable tumours in the inner side of the knee, composed of numerous convolutions of the vein; connected, and surrounded by a large mass of indurated cellular texture, which had an œdematous feel. The trunk of the vein could be felt under the skin enlarged and indurated, for five inches above and below the tumours. A slight blush of red was particularly observable on the skin covering the diseased vessels, more especially over the two tumours, which were acutely painful, so that moving the limb, or bearing upon it, caused great suffering. The pulse was small and frequent; skin hot; tongue white; bowels constipated, and appetite bad. Twenty leeches were ordered to the leg, and a purgative prescribed.

The pain, redness, and swelling of the varicose tumours, with general feverishness unfortunately led to a suspicion that matter might have formed, a small puncture was therefore made into one of them; but only

a few drops of blood flowed out. The leeches were repeated the next day, with considerable relief to the local and general symptoms. The following day there was a severe rigor, with exacerbation of the inflammatory fever.

The symptoms continued with frequent shivering fits, irritability, and quick pulse, for the next six days; although the most active antiphlogistic treatment was employed. On the eleventh day, her face was pale and anxious, she lay prostrate in bed, the fits recurred more frequently, and the restlessness and irritability increased. The pulse was small, weak, and 128; bowels frequently moved—stools black and fœtid. In this state she was bled to fourteen ounces, and during the operation the pulse rose, which was followed by a quiet sleep. When she awoke all the symptoms were found mitigated. She continued better the three following days, but was annoyed with sickness and frequent retching. On the fourth day she appeared more depressed; the shivering, sickness, vomiting, and restlessness increased. A thin bloody fluid proceeded from the wound in the vein; which was neither so swelled nor so painful as before the operation. The veins above the knee were still swollen, but less sensible than before; but below this part the phlebitis seemed advancing, from the distension and pain of the anastomosing veins on the anterior part of the leg, where there was a painful swelling, particularly evident in the calf of the leg. The foot was œdematous. The painful swelling of the leg increased, and the abdomen was distended with flatus. These acute symptoms were followed by those of great debility, when her sufferings diminished. Her countenance became pale and ghastly, she lay prostrate in bed, and was at times delirious. Pulse small, weak, and 114; skin occasionally moist and clammy; tongue, first white, and afterwards brown and dry. Her stomach was particularly disturbed; felt great thirst, and almost constant nausea and vomiting. She had frequent shivering fits. From the puncture made in the vein, there continued a tolerably free discharge of a thin bloody fluid. As the disease advanced, the redness and sensibility of the inflamed veins diminished, the abdomen became more distended, and the legs more œdematous. These symptoms increased, and she died on the 25th October.

On dissection the coats of the varicose veins were thickened and hardened, and a similar change had occurred in the surrounding cellular texture, which firmly adhered to them. The internal membrane of the varicose veins was converted into an irregular surface, and red colour, which was more vivid as we approached the wound, where pus was found. The varicose veins of the leg were filled with condensed blood, which adhered intimately to the internal membrane, and at different parts contained pus, leaving only a small external portion, forming what

is called a false membrane, to the middle of the thigh, where the vessel was filled with pus, until the vein entered the femoral trunk. The profunda vein was inflamed, thickened, and filled up with adherent condensed blood. The femoral vein contained also a large portion, which extended from the entrance of the saphena to beyond the termination of the profunda; below this point it was found completely filled with thin pus, and its internal surface was covered with an irregular yellowish membrane to the knee-joint, where it had been unfortunately divided. The vena cava to the heart was of a dark, dull red, or mahogany colour—the right side of the heart and the pulmonary artery were of a deeper hue; whilst the left was of a more florid colour. The aorta, near its origin, presented a deep scarlet colour, which was not changed by washing, although it disappeared by maceration. The abdomen was almost completely filled up by the colon, which was distended with air to an immense size. The uterus contained some tubercles. The other viscera of the abdomen and thorax appeared healthy. The head was not examined.

The next case affords an interesting example of the impunity with which an inflamed vein may be freely opened, when in the second, or suppurative stage.

A young woman of a weak habit of body was admitted into the Hospital of St. Louis, Paris, on account of an indolent ulcer in the leg, produced by some varicose veins having become inflamed from walking. When admitted there was found an exquisitely painful swelling along the course of the vein a little below the middle of the outside of the leg, and along the superior part of its internal side. These swelled portions had an erysipelatous blush, and the inflammation was accompanied with considerable symptomatic fever. Three days after admission M. Richerand felt matter, and made an incision four inches long, below and towards the internal side of the joint; when a considerable quantity of thick pus was discharged, mixed with blood, from the vessels divided by the incision. Another was made on the external side of the leg, and the same mixture of blood and matter was evacuated. When the thigh was examined, a red streak was found extending along the course of the saphena vein, which was hard, and painful. Several days after the first abscesses were opened, another was discovered at the upper and inner part of the knee, and pus was discharged. Low diet, poultices, &c., were continued, and she slowly recovered. The varicose ulcer healed, and the venous circulation was carried on by anastomosing branches.

This is an important case, as it proves the advantages of slitting up veins when suppurating; and forms a contrast to the following :—

A strong healthy man named Perron, aged 39 years, was admitted into hospital on the 10th January, on account of a diseased knee-joint. He had a number of varicose veins on one of his legs, which he was recommended to have cured whilst he remained in hospital. For a considerable time he would not consent to an operation, as he had never suffered any inconvenience from them; but the surgeon insisted on the importance of having them cured before they formed ulcers or the like, which would incapacitate him from work. Such reasoning at length prevailed, and the following operation was performed:—

Immediately below the inner side of the knee an incision was made two inches long in the direction of the principal trunk of the saphena major. The vein was then slit open to the same distance; and it was allowed to bleed until nearly two pounds were lost. Lint was placed between its edges, a compress over both extremities of the exposed vessel, and the whole secured by a roller. The wound suppurated freely, and twelve days after the operation it had nearly healed up without the occurrence of one untoward symptom; but in the evening of that day he complained of the bandage being too tight, and when the dressing was removed, a slight blush of inflammation appeared round the wound made in the vein. Soon after he had a long and severe shivering fit, followed by heat of skin, thirst, loss of appetite, and great anxiety. The following day, the 27th January, he remained in much the same state. A dose of castor oil and an acidulated drink were prescribed.

28th.—Last evening the fever increased, and during the night he was delirious. He had several stools, and now appears very weak and anxious. The leg continues swelled and painful, and numerous large tortuous veins are seen ramifying upon the leg, which is very hot. The saphena major was divided above the middle of the thigh, and the blood was allowed to flow for some time.

29th.—Complains much of severe though vague pain in the leg and arm, of the same side, although nothing unnatural could be detected externally. Says he is better, and the division of the vein, with bleeding, seem to have mitigated somewhat the severity of the symptoms. He complains of thirst; has no appetite; his tongue is white, and very dry, with a disagreeable taste in his mouth—diarrhœa—pulse small, and 114. The foot and leg of the side operated on is more distended.

30th.—The weakness increases, and his face is becoming hippocratic and anxious. The left leg is infiltered, and a red streak follows the

course of the saphena veins, which are distended, and very painful as far as Poupart's ligament. The left arm continues likewise infiltered and painful.

31st.—Continued sinking, and died during the night.

On dissection, the wound made in the vein (at *a*, fig. 2) was externally of a dark red colour, and nearly cicatrised. Above this point (at *b*) the vein was open, and discharged a sanious kind of fluid. The course of the saphena vein was indicated by a red streak, which gradually disappeared as it approached Poupart's ligament. This redness proceeded from the cellular substance encircling the vein being of the same colour, which appeared to be caused by the increased vascularity of the part, and to a change in the quality of the blood and tunics of the veins. The subcutaneous veins of the leg, excepting the saphena major, were filled with dark semiliquid blood, which gave them a distended and blue appearance. These tortuous veins formed by their convolutions several tumours, which were particularly evident near the inner side of the knee-joint, above which they terminated in a large trunk. This was distended with consolidated blood (as at *c*); on removing which, the veins were found forming numerous tortuous cavities intersected by tendinous-looking bands, which extended from one part of the internal surface of the vein to another, to strengthen it. In some places bundles of fibrous digitations were found, and at others the tissue appeared thick and hardened. Where one of these veins made a turn on itself, the angle of the vessel was condensed, and an ossific deposit was found.

The cellular substance and vein was converted into a dense mass, of a dark red colour (at *a*), where the vein had been opened during life. For two inches it was completely obliterated; and above this part, the tissue of the saphena major was thickened and vascular, and filled with a reddish sero-purulent fluid. The vein was in this state for several inches above the obliterated part, where it was found to end in an imperfect condensation of blood. Several collateral branches terminating in the diseased trunk were found inflamed, and filled with sero-purulent fluid.

The cartilages of the knee-joint were partially absorbed, the synovial membrane thickened and diseased, and the cavity contained several ounces of pus.

The right side of the heart was filled with firmly adhering coagula of blood, and the internal membrane was unusually red, which was particularly evident when compared with the pale colour of the internal membrane of the left.

Some serum was found under the dura mater, and a gelatinous matter between the arachnoid and pia mater. The substance of the brain was firm, but more vascular than when in a healthy state.

In the typhoid, or low stage of the disease, great attention should be paid to airing the ward, and diffusible stimulants may be exhibited with advantage, so as to impart a preternatural energy, which may resist and extinguish the diseased action.

CHAPTER VI.

CHRONIC PHLEBITIS.

The circulation of blood in veins is produced by the force with which the arterial blood is sent from the heart, assisted by the elasticity of the vessels, by the contractions of the neighbouring parts, and by the tendency towards a vacuum produced in the chest during expiration ; while a retrograde movement of blood in veins is prevented by their frequent anastomosis, by the large capacity of the veins over the arteries, and by the valves.   But there are other causes which often impede the circulation in those branches of veins which are sometimes increased in length and size, such as a natural weakness, particularly as age advances, or from the blood moving against its own gravity.   Other veins have an unusual quantity of blood sent to them from the pressure of distended organs, as of the uterus, colon, &c., or from branches of veins being partially obstructed by their position, or exposed situation, as of the deep veins of the leg during the action of the muscles in standing, around old ulcers, cancerous tumours, &c.

As the effects of inflammation on the blood has been already considered, I shall confine the following remarks to the influence of chronic inflammation on the tissue of veins in general, and on the production of a varicose state of the veins.

SECTION I.

Effects of Chronic Inflammation on the Tissue of Veins.

In old age the action of the heart is weaker, and the veins are more distended than in the young ; and this accumulation of blood in veins, enlarges their anastomosing branches, and this local irritation produces an increased vascularity and thickening of their tissue, until it is able to resist the further influx of blood. In this thickened state the vein loses its elasticity, particu-

larly where it is weakest, and least supported by neighbouring parts. This enlargement and thickening does not take place uniformly, but according as the influence of the blood affects the part, from its position, the situation of its valves, &c., which affords more or less resistance to the accumulation of the blood. At one place the tissue of the vein becomes thickened, and is sometimes converted into a substance like cartilage and bone, whilst at other parts the coat of the vessel, from weakness, yields to the pressure of the blood, which, accumulating in the part, increases its length, gives it a tortuous, rounded figure, and where superficial, the dark venous blood may be seen through the skin and thin tissue of the vein at certain parts.

In a more chronic form of phlebitis, the fibrous coat of the vein thickens ; and other stimulants besides inflammation appear to produce this effect. M. Beclard found the femoral vein thickened, and its tissue containing a deposit of bone, from the influence of the arterial blood, as it was only at the part where the veins touched the arteries, that the hypertrophy was observed. M. Recherand* dissected a basilic vein which had had a communication with the artery forming a varicose aneurism, and had received arterial blood for eight years before. The tissue of the vein was thick, and of a yellowish colour, and had much the appearance of an artery ; while the artery which communicated with it was thin, and had a greyish appearance, like the veins. Mr. Wilson† found the veins much thickened in a woman who died of puerperal fever. Such changes are not of so rare occurrence as is generally supposed, and in some cases of inflammation the tunics of the veins are much increased in thickness and density, and the caliber of the vessel is so reduced as not to admit the passage of blood through some of them. Fatty tumours are sometimes formed in the tissue of the vein; this, however, is of rare occurrence.

Chronic inflammation tends to produce hypertrophy of the tissue of veins, and by degrees it becomes changed into a cartilaginous substance, in which deposits of bone sometimes take place, without any change in the internal membrane. Such cases most frequently happen in old persons, when there is a natural disposition to the formation of bone. In the Ephemerides des

* Histoire des Progress Recents de la Chirurgie, p. 116 ; Larrey, Bullet. de la Fac. de Med., Paris, 1812.　　† Transactions of a Society, vol. i. p. 134.

part. After the operation, pressure was made over the wound, to prevent hemorrhage, and to insure its obliteration, while it diminished the danger of phlebitis.* M. Lesfranc made an incision over the varicose vein, dissected it from its cellular substance, and removed three inches; the wound was brought together, and compresses were placed over the vein above and below the wound. His pupil, Dr. Amblard, has given the result of this method of operating, and among others the following instructive case :—

A female was admitted into La Pitié, who had been afflicted with an ulcer in the leg for three months, from several varicose veins, for the removal of which, the two saphena veins were divided on the 17th September, and to prevent phlebitis, the limb was compressed above and below the wound. No bad symptoms appeared for four days after the operation, in which time the ulcer had diminished; but on the fifth day, the internal saphena vein was found swelled, by a "coagulum of blood." On the eighth day hemorrhage occurred from the wound, and pain was felt along the inner side of the thigh. On the ninth day the patient had no appetite, her tongue was red, and she had great pain in the limb. These symptoms were much increased by an imprudence in diet, followed by typhoid symptoms, which proved fatal on the twelfth day after the operation. On dissection, redness extended along the course of the saphena veins, which were thickened, and pus was found in the pelvic veins. The stomach was red, and the vessels of the brain engorged.

Dr. Amblard has related another fatal case.†

Other surgeons recommend passing needles under varicose vessels, and then twisting a ligature round their projecting extremities, so as to obliterate the vessel without opening it. Mr. Philips proposes to produce the irritation by transfixing the vessels by sewing needles, and assisting their action by galvanism; which has the twofold disadvantage of producing phlebitis, and also preventing the consolidation of the blood by which the obliteration of the vessel is obtained. Mr. Mayo recommends an eschar with caustic over the vein, at a sound part of its course above the varix; and thus excite such inflammation in the vessel as might be sufficient to occasion obliteration of its cavity "by the effusion of lymph." Mr. Skey of St. Bartholomew's Hospital, has related several cases

* Med. and Chirurgical Transacts. vol. vii. p. 195.
† Theses de l'Ecole de Medecin, Paris.

in the Lancet, in which such an operation was followed with success.

Still, there is always a degree of danger attending these operations; even when the patient has been carefully prepared by strict attention to rest, and to diet and regimen, sometime before and after the operation, and the relief that is obtained is rather temporary than permanent. This is easily understood, from the principal vein of the limb being obstructed, and the smaller branches being engorged, and incapable of sending the blood forward, until the irritation has thickened their coats, and enlarged and deformed them where they are weakest. I examined a patient who had been operated on for a varicose ulcer of the leg two years before. The old ulcer had broken out again at the old place, and was surrounded by large tortuous branches of veins, and the patient was in a much worse state than he was before the operation.

For these important reasons, and as the result of experience, and of a consideration of the cases on record, the wounding, applying ligatures, or other irritants to varicose veins, must be considered as not justifiable. The individual may be in much distress on account of an ulcer in the leg, kept up by a varicose state of the veins, and cured by their removal; still, the surgeon is not entitled to perform a dangerous operation for a temporary period of relief, to be followed by an aggravation of the symptoms, and become predisposed to apoplexy, and other internal organic diseases, by the closure of large venous trunks.

Should such an operation be performed when the varicose veins are very troublesome, the smaller veins should always be operated on, as less liable to inflammation; and if a ligature is to be applied, it should be a broad flat one, and it should be removed a few hours after the operation, when the necessary consolidation of blood has been produced. As this is the effect required, it will be more readily done by pressure below, and external irritation upon the vessel, to consolidate its contents, which will prevent a dangerous degree of inflammation in the vein.

At the same time, I am of opinion that the surgeon should be satisfied with a palliative method of treatment for varicose veins, which should consist in guarding against the predisposing causes of varicose veins, and avoiding the exciting causes, particularly a plethoric state of the constitution, costiveness, and ligatures

round the limbs, and other causes retarding the return of the blood.

The veins must be supported by methodical pressure over the whole limb, by means of a laced stocking, a well-applied elastic bandage, or strappings and bandages, so as to produce local compression ; and when the varicose veins are accompanied with heat and irritation, the horizontal position of the limb, leeches, and cold astringent lotions covered with oil-silk, will increase the effects of the gentle pressure. "It seems to me," writes the experienced Mr. Syme, " the most judicious course in treating varix is to be satisfied with remedying its bad consequences, and using means to prevent their recurrence."* When numerous veins of a limb are affected, or when there is considerable irritation, it is thus to be subdued in the ordinary way, and the application of a weak solution of the nitrate of silver, covered with oiled skin, will be of great use, by soothing the veins, and strengthening the skin of the part ; and a solution of collodian to strengthen and support the weak veins, and palliate troublesome symptoms.

The existence of *varicose ulcers* require the same plan of treatment, with cold-water dressings, or the application of the black wash, to the ulcer. The methodical employment of adhesive straps will often be of use, and, with the horizontal position, graduated pressure of the limb, and a cooling regimen, will remove the disagreeable symptoms, and enable the patient to return to his usual occupation.

The veins round the rectum are in the position that render them liable to enlarge and become diseased, forming *piles ;* and when they are external and painful, I have found the application of strong nitric acid of much use, by stopping hemorrhage, and by producing a salutary influence upon the diseased vessels.

Ulceration of the coats of veins.—Phlebitis may terminate in *ulceration* of its tissue, which may commence from its proper tissue, or extend from the neighbouring parts.

a. In the former variety, when the cause of inflammation in veins is chronic, and the situation favourable for the more gradual progress of its effects, the coats of the vein become softened, thin, and weak ; and the valves and internal surface of the heart are frequently found to contain superficial ulcers. In such cases

* Principles of Surgery, p. 122.

the substance round these ulcers is softened, and in part absorbed. This is a state similar to that of arteries, in which it produces a certain degree of inflammation, and terminates in aneurismal enlargements ; but as the blood in the vein is propelled with little force, it tends only to promote absorption, and the vein is perforated at one or more points by ulcerations, which is followed by an effusion of blood into the surrounding cellular membrane. Portal* found the pericardium of a woman brought to the dissecting-room filled with blood. On examining the blood-vessels a portion of the vena cava within the pericardium was found irregular, and its internal surface ulcerated, and very thin at several points. At one of these weak parts a rupture had taken place. There are many similar cases† on record of ulceration, and rupture of the vena cava,‡ both in the pericardium and without it. The inferior vena cava (2) is more frequently ulcerated than the superior; while the pulmonary veins (3), and the smaller internal veins, are rarely ulcerated and ruptured. There are cases on record in which the coronary veins (4); the azygos (5); and intercostal (6); the subclavian (7); the vena porta (8); and the splenic (9) veins have been found ulcerated, and their contents effused.

b. Ulceration more rarely extends from the neighbouring parts to veins; as it is a law of the animal economy that parts threatened with ulceration are strengthened by granulations, and the tissue of veins ulcerate very slowly, and resist the entrance of extraneous matter into the circulation. Even when the person is weakened

---

* Anatomie Medicale, t. iii. p. 354.

† See Laurentius opera rarior, t. i., p. 55, Venetice, 1739. Billinus de morb, pect., &c.

‡ Sometimes those diseases of veins form bloody tumours, which include other parts in the disease ; and not unfrequently the neighbouring bones are softened, and in a pulpy state. In such cases amputation is generally necessary. See Med. Obs. and Inquiries, v. 3, p. 176.

(2) See cases related by De Haen, Herlungs methode, b. iv. s. 10, p. 391. Rolandus Ench, Anatomie, b. ii. c. 27. Gasserus Bonetius, l. c. lib. 215, obs. 3. Anatus Lusitanus, Histor. Univ., b. iv. c. 9. Bartholimus Musc. Natur. Curos dec. 1 an. 1 obs. 101. Andrius Lurantius Histor., anat. b. ix. p. 360-8, &c. &c.

(3) Morgagni Mimdilla soc. Italiana, v. xii. p. 4, &c. (4) Bertin traité des Maladies du cœur, p. 49. (5) Morgagni Epist. 26, § 29. (6) Portal, l. c. (7) Portal, l. c. (8) Bechat Anat. Gen., § 3, p. 355. (9) Morgagni Ep. 53, § 36.

by the ravages of sloughing phagedæna, and hospital gangrene, in which the ulceration advances rapidly, dissecting muscles, and laying vessels bare, large vessels are often found passing over the surface of the ulcer unopened, and strengthened by a covering of minute granulations.

In smaller veins, the inflammation of the parts which accompanies ulceration, produces a consolidation in the small, and a secretion of lymph upon the external surface of the neighbouring vessels, which forms a barrier to the progress of the ulceration. The ulceration of the fauces, after scarlatina in children, sometimes extends to large veins, and may prove fatal.* In the case of a large cancerous ulceration of the mamma, extending to the axilla, I found the axillary vein had thus been filled by consolidated blood, which had been slowly removed, and the vessel contracted and obliterated in the progress of the disease. Collateral branches, in this case, had carried on the circulation. Ulcers of the extremities, and of the intestines in weak persons, are not unfrequently accompanied with distressing and even fatal hemorrhage. Dr. Hennen relates the case of a soldier who was wounded by a musket ball in the face, and died ten days afterwards from hemorrhage, caused by a very minute fragment of the ball being lodged near the sinus of the left jugular vein, which inflamed the part, followed by an ulceration of the vessel, from which the blood proceeded.† Foul ulcers, in weak constitutions, may advance without much inflammation, and terminate in ulceration and hemorrhage. The most frequent examples of such hemorrhage occur in ulcers of the leg, produced by a varicose state of the veins of the part, when the weakness of the system, the slow manner in which the ulcer advances, and the little accompanying inflammation, prevents the formation of condensed blood. Mr. Liston has recorded the case of a female of dissipated habits, and of a scrofulous temperament, in whom an abscess formed a little below the middle of the neck, which terminated in an ulcer, from which a slight bleeding proceeded, followed by repeated hemorrhage, under which she sank. On examination after death, the ulcer in the neck was found to have extended to the jugular vein, which

* Med. Chirurg. Trans., v. 26.
† Principles of Military Surgery, 2d ed., p. 891.

had produced the fatal hemorrhage.*   In a case of extensive ulcera-
tion, M. Cruveilhier found the femoral vein, under Poupart's liga-
ment, perforated with holes, and containing a quantity of pus of a
reddish and viscid nature, like that of the contiguous abscess.
From the crural arch to where the saphena enters, the vein was
three times the size of the artery, and its tissue thick and dense.

CHAPTER VII.

RUPTURE OF VEINS.

The *rupture* of veins may take place when their tissue is softened
and weakened by inflammation, on any sudden movement or accu-
mulation of blood in the part,† particularly in old age, and when
the system is weak.   It is for these reasons hemorrhage so fre-
quently takes place in a varicose state of the veins, when there has
been a long accumulation of blood, and from its being out of the
direct line of the circulation, considerable losses may take place
without producing that debility that would be caused by such an
evacuation from a healthy vein.   In other cases the rupture takes
place by the forcible interruption of the circulation in the place
while riding, during cramps, convulsions, &c. &c.   Morgagni,
Ferrus, Bertin, &c., have related cases of such ruptures in veins.
On examination, the rupture is generally found to take place where
there is a reflection of the serous membrane, which, being unelastic,
and closer united to the vessel than elsewhere, prevents the yield-
ing of the vessel, and a rupture is the consequence.

Should a part of the body be struck against a hard substance,
pain is felt at the time ; and if near a joint, it becomes swollen, of
a dark colour, with stiffness and pain on motion.   These symptoms
gradually go off without the employment of any remedies.   In
such a case the concussion which the part receives ruptures some
of the blood vessels, particularly veins, which discharge blood into
the surrounding cellular tissue, and produces the swelling.   This
is increased by the determination of blood which takes place to the
injured part, and the effusion of a gelatinous matter around the

* Liston's Surgery, p. 189.
† Doubleday, Med. Obs. and Inq., vol. v. p. 144 ; Portal, l. c. 354.

part. The inflammation thus produced causes the pain, which is increased on motion. If the injury has been great, the inflammation passes on to suppuration, and a quantity of lymph is deposited upon the coagula of blood, from the increased vascularity of the part. From this irregular surface pus is secreted; and as the cavity increases in size, its surface becomes smooth, from the layer of lymph which covers it, and from a regular sac, much less vascular than in the primary stage.

Veins are sometimes ruptured by the action of powerful muscles; those of the extremities are most exposed to it, as these vessels are always distended with blood, and have fewer anastomosing branches. In the sixth number of the London Medical Repository there is a case related in which the internal iliac vein was ruptured during parturition. Experience has led me to suppose that purpura hemorrhagica and scorbutis consists in an inflammation, and consequent softening of the tissue of vessels from the nature of the individual constitution, or want of proper nourishment. In such cases frequent effusions of blood take place, and constitute one of the most characteristic symptoms of the disease.

External violence is a frequent cause of the rupture of veins. This is most frequently seen in such parts of the body as have much cellular substance, as round the eye, &c. These cases are of slight consequence, as the extravasated blood is rapidly absorbed without being followed by any bad consequences; but, when the vein is large, and effusion considerable, they become troublesome, and even dangerous. Mr. Ogh examined the body of a female who died in consequence of some blows she had received in the last month of pregnancy, and found the internal iliac vein ruptured, which appeared to have been the direct cause of her death.[*] Such cases, however, are rare; sometimes a more frequent rupture of large veins, and a considerable effusion of blood, follow injuries of the extremities, &c., which is of consequence to distinguish when the medical attendant sees the case, as limbs are frequently removed unnecessarily from supposing that such effusions come from the ruptured trunks of arteries. Many such examples might be cited; but it will be sufficient to relate the two following cases—the first is by Mr. Else :—†

* Merriman on Difficult Parturition, p. 116.
† Med. Obs. and Inquiries, v. iii. p. 169.

A man, aged 25, felt a cramp in his leg while raising a considerable weight. A tumour formed, and some time afterwards it was opened, and a large quantity of fluid and coagulated blood discharged. As it was considered to be a case of popliteal aneurism, the limb was amputated; and, on dissection, the arteries were found healthy throughout. The tumour was connected with the rupture of a large vein, which had an irregular torn edge, and situated immediately above a pair of valves. Some individuals seem to have a peculiar predisposition to such hemorrhages even when in good health. The following is an example of this kind :—

Henry Connel, a healthy porter, 45 years of age, " sprained" his left leg eight years ago, in descending from the top of a stage coach. Next day the leg was of a black colour, very much swollen, hard, and so painful that he could not stand. He sent for a surgeon, who ordered leeches and poultices, rest, abstinence, &c. In about three weeks after he could walk about. Since that time the leg has continued weaker, and of a yellowish colour.

Three weeks ago, while walking in a dark night, he fell, but did not suppose himself hurt, and walked some distance after the accident. The following day he went about as usual until the afternoon, when he felt the leg swollen and painful. These symptoms increased so much during the night, that he went next morning to the Aldergate Street Dispensary, where it was treated as an inflammatory affection by topical and general antiphlogistic means. After continuing a fortnight under this plan of treatment, and not finding himself better, he applied and was admitted into hospital the 8th January.

The leg was of a dark red colour, much swollen, and very hard from the knee to the ankle joint. He complained of severe pain in the leg, which increased by the exertion of being brought to the hospital. The pulse was natural, and 74. From the nature of the accident, its similarity to the former hurt of the leg, and the gradual development of the symptoms, I supposed it to be a case of a large effusion of blood, followed by inflammation; and this conjecture was strengthened by a feeling of deep-seated fluctuation under the knee-joint. To remove the great tension of the leg, and mitigate his sufferings, I made an incision into the part, which was followed by a gush of blood, in part coagulated. After allowing the evacuation of a considerable quantity, a large cavity could be felt in the calf of the leg. A tourniquet was applied, and one of the surgeons of the hospital sent for, who considered the effusion of blood to have proceeded from the rupture of one of the large arteries of the leg, and proposed amputation, as it would have been impossible to have secured an artery so deeply situated when the leg was in such a swollen

state from inflammation, and effusion of so much blood. The man would not submit to the operation until he had consulted his friends, and on that account it was deferred.

January 10th.—Still persisted in refusing to allow the leg to be amputated, as he had not seen his friends. As the tension and swelling was diminished, and the pulsation of the tibial arteries could be faintly distinguished, the wound was enlarged, and it was found that the large mass of coagulum was situated under the integuments. On cleaning the large surface with cold water, no bleeding followed, the wound was brought together, and cold cloths were constantly applied. Several slight bleedings took place, seemingly from the small arteries divided in enlarging the wound. This slowly healed " by granulations," and he was discharged a month after admission; but the leg was weak and subject to œdematous swelling after walking.

The saphena external vein, near its juncture with the popliteal, seemed to have been ruptured in this case. When the vein is smaller than in the present example, and the swelling increases slowly, a sac is formed, which enlarges on taking exercise, and again diminishes when the person is at rest. Mr. Else* found, on dissection, that a tumour of this kind in the neck was connected with the basilar vein, and had remained stationary for four years.

Sudden impediments to the return of the blood by the veins produces the same effect as sudden changes from heat to cold; which sometimes causes fatal internal hemorrhage, from the blood being suddenly accumulated in the right side of the heart and vena cava, from the cold contracting the cutaneous vessels, and from the long inspiration which is taken at the moment. The case observed by Helwin, as related in Haller's Physiology,† is a good example of the fatal consequences of suddenly immersing the body, when heated, into a cold bath. On dissection, an effusion of blood was found in the pericardium, from the rupture of the superior vena cava. Another example of the same kind is related by Portal.

Veins are sometimes ruptured from the position in which they are placed retarding the blood in its source. A familiar example of such a hemorrhage is seen in epistaxis produced by stooping. It is on this account, likewise, that when old ulcers occur in debilitated constitutions, they affect most commonly the inferior extremities, where the blood flows against its own gravity, and where

* Loc. cit.   † T. i. p. 129.

they are more subject to inflammation, as has been already explained. It is for the same reason that old ulcers are often surrounded with a dark-coloured halo, from the veins being gorged with blood, and from their tendency to become inflamed, they are apt to be ruptured, forming bloody tumours under the skin. The frequent rupture of internal vessels in the concrete œdema of infants proceeds from the congestion in the veins, in the thorax, and, still oftener, in the head, where the veins are unsupported, and the effusion soon proves fatal. The same is frequently the case when the head has been struck, and in the softening from inflammation of the brain, and the consolidation of blood in the capillaries, producing congestion and rupture of one or more vessels.

In some cases the sudden retardation of blood in a vein which is in a weak state, is followed by a rupture, without any disease being apparent in the vessel. The following appears to have been an example of this kind :—

Mr. Hay of Leeds relates the case of a child who suddenly screamed out in consequence of a fright, from which she did not recover for some time. Nothing particular was remarked for a fortnight afterwards, when the maid, in washing the child, observed a small tumour above the left clavicle, which was of a dark colour, on any violent emotion. It increased rapidly, and when Mr. Hay saw her it was about the size of a pigeon's egg, situated on the course of the external jugular vein. It felt soft, which led him to suppose it was a varicose vein, and in the course of a fortnight the tumour enlarged to four times its former size, and then reached from the angle of the jaw to below the clavicle. It was punctured with a couching needle, and about a quarter of an ounce of dark-coloured blood flowed out. The following day a small quantity more was removed after another puncture. Two days after a third puncture was made, after which the tumour became small. In the course of a week it was found again increased, and on another puncture being made, a quantity of liquid blood flowed out. From this time the tumour gradually lessened, and disappeared altogether.

Rupture of veins may take place from hardening, ossification, or vegetations of the valves of the heart, with contraction of their openings, particularly of the left side of the heart ; or from obstructions in the large arteries, as in the case related by Bertin of the contraction in the descending aorta, in which death occurred on

the rupture of the right auricle, and afterwards the coronary vein, and effusion of blood into the pericardium.[*] In these cases œdema takes place from sudden emotions of the mind, or violent exertions of the body.

The same ruptures of veins may occur from the softening of the tissue by inflammation.

The veins of the head are often ruptured by external violence; particularly those of the external surface of the brain. Such accidents are usually accompanied with spasm, or coma, partial paralysis, with rigidity or flaccidity of sets of muscles of one side, or of nearly the whole body. The intellectual faculties are deranged, and the patient complains of heaviness or pain in the head, which sometimes terminates in delirium.

Dr. Simpson has recorded an interesting case that occurred in the practice of Dr. Kyle of Dundee, in which a pregnant woman, in whom fatal hemorrhage took place while straining upon the nightstool. On dissection a recent aperture was found in one of the labia pudendi, which was traced into a large vein. Dr. Simpson supposed that one of the veins of the plexus of very large veins, at the root of each labium, probably in a varicose state, had burst.[†] Possibly the coat of the vein was thickened, as well as dilated, and consequently it would not collapse, as veins usually do, but remained open like an elastic artery, from which the fatal hemorrhage had proceeded.

CHAPTER VIII.

WOUNDS OF VEINS.

The treatment of wounded veins is peculiar; in order to stop the bleeding, and to avoid the risk of phlebitis. When the wounded vein is small, by exposing it to cold, and applying temporary pressure upon its cut surface, and externally upon the course of the veins, will be sufficient to stop the bleeding. When larger veins are divided, in operations, care should be taken to draw out the extremities of the arteries, and pass the small ligatures upon them, so as to divide their fibrous coat, and exclude the accompanying

---

[*] L. c., p. 160; and the original in the observations of A. Winstow and A. Cooper. See Trans. of Hodson on Arteries, by Breschet.

[†] Obstetric Works, vol. i. p. 305. Edin. Med. and Surg. Jour. v. 36, 1831.

vein ; but when, from the size or situation of the vein a ligature is necessary to stop the bleeding, it should be remembered that it acts differently from a ligature applied to an artery. In this case, the internal and middle coats of the artery are divided, which produces such an irritation as consolidates a portion of blood, and produces a secretion from the inflamed tissue, which closes the cut extremity. In the case of a vein, the ligature divides partially the cellular and middle coats, and leaves the internal membrane whole. This is the effect even when the ligature is tied tight ; and its application in this manner only tends to increase the dangerous irritation in the internal membrane, without affording any aid to the healing process further than bringing the sides of the vessel together.

In such cases, therefore, a *flat* ligature should be applied to wounded veins, with only such a degree of tightness as may stop the hemorrhage, and prevent its recurrence, by a knot which will admit of the ligature's being removed an hour or two after the application, or at least at the first dressing. The effect of a ligature upon a vein, artery, and nerve, are represented in Fig. 6 (*a* and *b*). The person died two days after the operation from phlebitis. The following is the result of the proposed method of treating bleeding veins during amputations, which I transcribe from my note-book :—

John Fulton, æt. 23, had his thigh amputated above the knee, in consequence of an old disease of that joint. The femoral vein continued to bleed so obstinately, after various attempts to check it, that a ligature was found necessary. Only one knot was applied to the ligature, which was removed at the first dressing. A compress was placed externally along the course of the vein. No hemorrhage supervened, and the patient had a favourable recovery.

This method is peculiarly necessary when a ligature is to be applied to a varicose vein, or to piles, as in these cases the thickened coats and slow circulation predispose them to inflammation, and such an irritation will be produced in the vessel as will consolidate the blood in it. Should this irritation be continued, by allowing the ligature to remain, phlebitis and its most dangerous consequences will ensue.

Varicose or Venous Aneurism.

When the accompanying vein is at the same time wounded with the artery, the blood is propelled into the cellular tissue, which it distends, and meeting with resistance, passes into the yielding cavity of the vein, and the arterial blood circulates more or less completely through the vein. The most frequent example of such wounds occurs on venesection, when the lancet is pushed too deep, so as to transfix the vein, and wound the artery which is immediately under it. When this is found to have occurred, the five fingers should be bandaged separately, and extended up the arm. A dossil of lint, placed over the closed wound, with graduated compresses over it and the brachial artery, to retard the blood in the vessel, and to enable the wounds to heal without obliterating the vessels. Sometimes the wound of the artery is so considerable, that a great extravasation of blood takes place into the cellular substance ; and from the irritation which it causes, and the little blood which passes to nourish the limb, it becomes cold and livid, unless an operation is performed by opening the swelling over the wounded artery, which is easily seen on removing the clotted blood, and tying the artery above and below the wound.

When the wound in the artery is smaller, and the blood circulates through the vein; the neighbouring parts unite, and a permanent passage is formed, which gives rise to this variety of aneurism. Indeed, the name is an improper one, as aneurism should be confined to enlargements of arteries. As the vein receives more vital blood, which is propelled with force into the vessel, its tunics become thickened and varicose, a peculiar whizzing sound may be heard from the blood passing into the vein, while an obscure pulsation extends some way along this vessel. When the blood passes along the vein against its own gravity, or when pressure is made (proximid) of the wound in the artery, the distended state of the vein is diminished, and the blood is dark, and passes in a stream, whereas jets of florid-coloured blood will follow, compressing the artery under (distid) the wound. This, with the history of the case, sufficiently proves the nature of the disease. The tumour that forms in the cellular tissue between the artery and vein, is generally small, soft, and

yielding. The size it attains soon after the injury remains stationary, or increases very slowly. It has thus been found to remain for thirty or forty years, and in no case on record has it proved fatal.

The inconvenience which this injury produces, varies with the vessel injured, the temperament of the person, &c. In general, the member which the wounded artery ought to supply with blood, becomes weak, and a painful pulsation or weight is complained of, and, in some cases, the disagreeable feeling in the part is not relieved by the usual means, and the pain becomes so distressing, that the patient is desirous to have it relieved by remedies, which consist in supporting the enlarged vein by bandages, and by the application of cold ; while rest is enjoined, low diet, the exhibition of digitalis and lead, and occasional small bleedings. If it be the artery of an extremity, methodical pressure and irritating applications are at the same time to be made upon the artery proximid of the wound, so as to obliterate it by the irritation and consolidation of blood, which closes the wound in the artery. Such a method of treatment is tedious and uncertain ; and when the bleeding is considerable, and the symptoms distressing, the radical treatment may be preferred in rare cases, when other means fail. This consists in supplying a tourniquet upon the humoral artery, laying open the sac, and securing the vessel with a ligature, above and below the wound. Should the limb be swollen, it will be sufficient to tie the wounded artery above this part, as this will generally be found sufficient, especially where antiphlogistic remedies and proper bandages are employed at the same time.*

Since the time Dr. William Hunter first described varicose aneurism,† Cleghorn, Guallani, Else, and many other surgeons, have described cases of this disease. Baron Larrey saw a case in which the popliteal vessels were in a varicose aneurism ;‡ and his son has related one in which the axillary vessels were so wounded.§ In 1825, I saw an interesting case of the same kind under Baron Larrey's care, of whom he gave me the following account :—When the soldier (æt. 30) was admitted into the hospital, five months after receiving the sabre wound, four inches above the symphysis pubis, on the left side of the linea alba, and passed

---

* See Guthrie on Wounds and Injuries of Arteries, 1846, p. 83.
† Med. Obs. and Researches, vols. i. and ii. for 1757.
‡ Med. Op. tom. ii. § Memoirs et Campaigns, tom. iv.

inwards and downwards towards the left side. A considerable hemorrhage followed, and an extensive extravasation into the neighbouring parts. By the employment of rest, and the common discussent remedies, the extravasation was soon dispersed, and he was discharged. Ten days after leaving the hospital, he again presented himself, with a pulsatory tumour, the size of a pullet's egg, immediately above the middle of Poupart's ligament of the left side, which, from the peculiar noise which it emitted, and from its effects upon the neighbouring vessels, was found to be a case of varicose aneurism. The patient was placed in bed, with his hip-joint half bent, and ice was applied for eight hours daily. When I examined him, five months after the accident, there was no tumour, and very little additional pulsation could be detected. If to this judicious treatment of perfect rest, and a careful regimen, the use of digitalis, graduated pressure over the artery, and stimulating frictions over the sac or swelling, had been employed, more might have been accomplished. Such a plan of treatment affords a much better opportunity of securing the artery, should that be required.

In another case, the subclavian vessels were wounded,[*] forming a varicose aneurism. Baron Larrey allowed me to examine it, when I found a small soft tumour over the seat of the wound in the artery, which had remained for years stationary, without any disagreeable symptoms, and affords a good example of the importance of avoiding all interference as long as possible. Williamini saw a case in which the carotid vessels were affected with varicose aneurism.[†]

CHAPTER IX.

INTRODUCTION OF AIR INTO VEINS.

A number of authenticated cases prove the dangerous consequences of introducing air through wounds made in veins situated near the heart, and by other means. This occurrence is explained by the auricles of the heart acting not only like an expelling pump when they drive the blood into the ventricles, but they have the power of suction when they dilate themselves, and thus draw the

[*] See l. c. tom. iv.
[†] Journal Com. des Sciences Medicale, tom. xi. p. 91.

blood from the two large inactive cavæ, and consequently from the large vessels connected with these trunks. At the moment of the introduction of the air, a bubbling sound is sometimes heard, like the passage of air through water, and bubbles may be seen mixed with the venous blood. .

The symptoms of the introduction of air into veins is sudden, and most alarming. The patient feels faint, extremely anxious, and struggles for breath; his countenance becomes livid, and the muscles are agitated by convulsive movements; a deep, laboured, and stertorous breathing, like a person labouring under an apoplectic fit, and a small quick pulse, followed by insensibility. In favourable cases, the leaden colour of the cheek assumes, with different parts of the body, a red tinge, respiration becomes more frequent and less laborious, the pulse stronger and more natural, and the patient rises as from a sleep. When more air has been introduced, and the effects more dangerous, the breathing becomes more feeble, with occasional flushing, the pulse is less distinct, and the extremities cold, followed by death.

In an article on the subject in the American Cyclopædia of Practical Medicine, Dr. Warren of Boston relates two cases which occurred in his practice. The first case, while still comatose, the leaden colour in the cheeks assumed a reddish tinge, and the alarming character of the symptoms diminished. In the second case, the livid colour of the cheeks gave place to a suffusion of vermillion red, which soon passed off, and the patient died.

Dr. Simpson has seen several cases in which great depression followed delivery, a rapid and almost imperceptible pulse, and patches of an erratic scarlatinoid rash upon the surface. All the patients died within two or three days after delivery. This distinguished physician explains these cases by air having been forced into open veins at a distance from the heart, from the peculiar mechanism of the part. The interior surface of the uterus, especially opposite the late seat of the placenta, has a number of ruptured venous orifices opening upon it. The air introduced into the uterus, during the alternate relaxations and contractions of the walls of the organ, may be prevented being expelled by the pressure of a clot of blood at the os uteri, and, under the compression to which it is subjected, be driven into the open venous orifices existing in the lining membrane of the uterus. In a fatal case of this kind, Dr. Simpson

examined the body under water. "The lower vena cava, but especially the uterine and hypogastric veins, were distended with frothy blood, and air bubbled up through the water when any of these tubes were opened. The larger veins in the extremities were in the same state." [*]

The means of preventing these most dangerous consequences is impossible ; and to relieve the symptoms, stop the orifice of a wound in a vein near the heart with the finger, and press upon the vessel between the wounded part and the heart. The patient is to endeavour to expel the air from the lungs, and his position is to be changed to a horizontal one, cold water dashed on the face, and stimulants applied to the nose. When the uterine veins are the cause of the dangerous symptoms, the obstructions at the os uteri are to be removed, and the position of the patient changed. The rest of the treatment must be varied by the urgency of the symptoms ; great difficulty in breathing may be relieved by the removal of a little blood, and the faintness relieved by stimulants applied to the mouth and nostrils, and heat and friction to the extremities.

BOOK III.

DISEASES OF THE CAPILLARY VESSELS.

The vital actions of the body, both healthy and diseased, are carried on by capillary vessels. As seen by the assistance of a good microscope, they consist in the extremities of the arteries forming a continuous network, from which the small branches of veins arise. These capillary arteries and veins anastomose, and are nearly of the same size throughout the network, and thus differ from the larger branches of arteries and veins, which progressively diminish and increase in their progress. The blood corpuscles vary in size from $\frac{4}{1000}$ to $\frac{4}{1000}$ to $\frac{6}{1000}$. These are the simplest form of a homogeneous germ, which consists of a cell that may divide, or become nucleated, with a perepherat portion called *endoplast*, con-

[*] Simpson's Obstetric Works, vol. i. p. 813.

taining a clear liquid. This globule or cell was supposed to be of the simplest form, and starting point of life; and at one time was considered, like those of plants, from the simple yest plant to the complicated structure formed by a metamorphosis of cells. The component elements and tissues of the higher classes of organized beings were supposed to be derived from the nucleated origin; but more recent and extended investigations of physiologists indicate that the fibrous and other tissues are formed by the *consolidation* of the plasma, or formative fluid, without passing through the intermediate condition of cells.

The diseases of capillary vessels are either functional, producing debility in the part; or organic, including inflammation, and changes in the form of capillaries.

CHAPTER I.

DISORDERS OF THE FUNCTIONS OF CAPILLARY VESSELS.

These disorders may be attributed to alterations in their vitality, indicated by changes in their properties, and debility, or venous congestion.

SECTION I.

Alterations in their Vitality.

The functions of capillaries may be so deranged as not to absorb the quantity of nutrition from the intestinal canal, required for the purposes of the system; or the blood may not undergo the necessary renovation in the lungs for the expenditure of the body. Such a state often occurs in the course of chronic diseases, &c., producing emaciation, and other symptoms constituting the disease called anemia.

SECTION II.

Debility of the Capillaries.

Such a degree of debility of one part of these vessels destroys the balance of different parts of the circulation, such as that between the arteries which perform secretion, and the absorbents. When the system is weakened, the heart often sends the blood to the extreme vessels with more force than the capillaries can absorb, and the veins return the blood; the consequence is, an accumulation of

serum occurs in the cellular tissue and serous sacs, forming dropsy. Familiar examples of this are seen in young females affected with chlorosis ; in weak individuals from walking about too soon, especially after any protracted illness ; and in strong persons from keeping the legs in a pendant position for a long time.

Venous congestions are sometimes produced by an unusual pressure upon the trunks of veins, or a consolidation of blood in the principal vessels of the part. These causes retard the circulation, impede absorption, and produce dropsy.

Such facts prove the importance of attending to the state of the blood, in regulating the kind of remedies required for preventing or removing these diseases. Sometimes the vitality of the blood requires to be increased, at other times diminished. At one time, the functions of an organ require to be stimulated, so as to assist the action of its vessels in absorbing the necessary quantity of fluid ; and in another case to be diminished, so as to prevent too great an absorption in one organ, and too little in another.

CHAPTER II.

ORGANIC DISEASES OF CAPILLARY VESSELS.

These diseases are so obscure in their nature, that I shall confine myself to the consideration of those which are indicated by inflammation, and changes in their form.
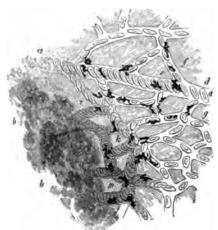
SECTION I.

Inflammation in Capillary Vessels.

When capillaries are viewed in the web of a frog's foot, or in the wing of a long-eared bat, the rythm and vascular action is well marked ; and on irritating a point, a more rapid flow, and a more numerous collection of globules are directed to the part. The disks approximate much in the same way, as they form into cylindrical rouleaux out of the body ; and after vacillating backwards and forwards for some time, they get more and more crowded, until the vessel appears to be filled up with the red globules. In large arteries and veins, we have seen that in an irritable state the plasma and globules of the blood consolidate into a mass, that may

again be dissipated, or may be gradually converted into a substance like cartilage and bone; or be softened and converted into pus. We have followed these changes in the large vessels in the first part of this essay. Similar ones more readily and extensively take place in the capillary vessels; but from the thickening of the neighbouring parts, they cannot be followed, and are more readily understood from the changes which take place in the larger vessels when inflamed.

A slight irritation was produced in the web of a frog's foot, and it was examined next day with the assistance of a powerful microscope.

A large vessel (a) was filled with red blood, which appeared at first stagnant, but on observing it carefully, a slight oscillating movement appeared at (e); and (at f and g) there was a rapid circulation; and in some of these vessels there was a crowding of globules, so that at times they appeared to stop, until they were able to pass often sideways into the smaller vessels, by the vis a tergo. Some of these vessels were filled with white globules, and others with disks, tinged red. The globules in the branches (i, k, m), which proceeded from the trunk (a), were quite stagnant, and terminated in the whitish ash-coloured effusion of coagulable lymph (at b, b), where the capillaries were filled with stagnant red blood. This was the part that had been slightly wounded, upon which coagulated lymph had been deposited, and the contents of the vessels around them contained red blood, in a state of consolidation.

When inflammation affects a part, its vital powers are augmented, and the vessels are in consequence increased in their action by their proximity, and connection with the inflamed parts. The capillary tubes, when they are the seat of the inflammation, and weakened in their tissue, are softened, and from the blood being propelled in larger quantities, and with greater force into the

2 c

irritated parts, they frequently burst.   As this form of hemorrhage is generally produced by an internal cause, and is accompanied with a certain degree of fever, it is called active hemorrhage.

These evacuations are influenced by the state of the vessels, which render the blood more vital, and consequently thinner and more florid in colour, and it coagulates more slowly than in the healthy state.   Hence in this disease the blood, as well as the tissue of the vessels, are affected.   In some individuals the disposition to hemorrhage is hereditary, being confined to particular families; and in these cases the whole capillary vessels have congenitally this disposition; and from the softening of the vessels of the skin, blood is effused into the subcutaneous cellular tissue, forming the disease named purpura hemorrhagica.   There are two varieties of this disease—an acute and a chronic variety.

In the acute form the fever is generally considerable, the pulse quick and hard, and the superficial veins prominent and wiry.   In these cases small bleedings relieve the symptoms, and the cruor is hard, and contracted into a firm, concave upper surface, which is buffed.   Small doses of calomel and opium, and the occasional exhibition of aperient medicines, are found of benefit in such cases.

The more chronic form of purpura hemorrhagica occurs in enfeebled constitutions from the improper use of mercury, from disease, bad food, &c.

John Porter, æt. 40, had undergone a course of mercury for a syphilitic complaint, and when under its influence was exposed to inclement weather, soon after which he complained of pain in his throat. This was followed by such a severe attack of epistaxis as to oblige him to apply for assistance.   Three days after admission into the hospital, the epistaxis recurred, and after it was stopped it again burst out, and was arrested with difficulty.   The gums were next observed to be soft, and to bleed, and small purple spots, which, when first noticed over the body, were considered as flea-bites.   On a more careful examination they were found to be of different sizes, and on several parts of the body there were large oval-shaped blotches or vibices.   The patient complained of weakness, and his body was much emaciated from the loss of blood.   He had a haggard look, his appetite was indifferent, his bowels constipated, and his pulse small and hard.   He was bled to ten ounces, and a dose of calomel and jalap exhibited.   The blood was cupped, and the coagulum very tough.   After the bowels were freely affected, he felt

easier, looked better, and the petechiæ had nearly disappeared. Two days after he was again bled to ten ounces. The blood was buffed, but the coagulum was not tough. The pulse was small, wiry, and 95 before the bleeding, and rose to 112. These symptoms proved that the bleeding could not be carried farther. Next day the epistaxis occurred in a much less degree. The breath was heavy, the tongue brown, and the bowels constipated. A dose of calomel and aperients were administered, and repeated as required. With nourishing diet he soon improved, and was discharged a fortnight after, well.

It was noticed in this case that the hard and prominent appearance of the veins disappeared as the symptoms yielded.

The following case of purpura hemorrhagica appeared in the course of a dangerous disease :—

A middle-aged female, who had resided for seventeen years in India, was attacked with indigestion and other symptoms of derangement of the liver. She was œdematous, with a coated tongue, and the characteristic and dangerous symptoms of a dry, black streak along its centre ; and numerous petechiæ and vibices over the body, with bleeding from all the mucous surfaces. Even under these desperate circumstances, relief to all the symptoms followed the removal of a few ounces of blood.

The following congenital weakness of arteries is related by Mr. Wilson :—*

A fine healthy, but delicate child, with a pulse soft, and viscera which performed their functions in a healthy way, was so delicate that the least pressure produced black and blue marks on the parts. Bruises were followed by livid coloured marks ; the scratch of a pin was followed by a bleeding which was stopped with difficulty, and a leech-bite was followed by a most dangerous loss of blood. Between three and four years of age the child bit its tongue, so severely, as to leave the impression of the teeth on the upper and under surface. The bleeding from these wounds could not be checked by any means—compression, caustic, styptics—and and the ligature only afforded temporary relief. The ligature soon ulcerated, and the child sank from weakness. What appeared to have had most influence upon the hemorrhage, was the class of styptics which seem to act by hastening the coagulation of the blood.

The body was examined, and the only diseased appearance found was an unusual thinness of the aorta and its branches, which resembled veins more than arteries. Their coats being not more than one-half the usual

* Loc. cit. p. 440.

thickness, and without enough of elasticity to preserve their cylindrical form when the blood had been removed. There seemed to be a deficiency of the muscular tissue which was not strong enough to be burst by the propelling power of the heart, but gave way on being partially pressed, and allowed the blood to escape. The weakness of the child seemed not to have been produced by the bruises being followed by inflammation, as the extravasated blood was soon removed by the absorbents. Even the vaccine pustules were attended with less inflammation than usual. The veins appeared strong and healthy.

It is worthy of remark that although the parents of this child were strong and healthy, their male children had all the same tendency to hemorrhage.

Scurvy is an example of a more chronic form of the same disease.

<center>SECTION II.</center>

<center>*Rupture of Capillary Vessels in Organs.*</center>

a. *Brain and Spinal Marrow.*—Branches of capillaries are not unfrequently burst in the head from injuries, or from a softening of the brain from inflammation.

The most common examples of injuries producing an effusion of blood upon the brain or spinal marrow, are from the concussion of falls or blows, the ossification of the tissue of arteries, or the bursting of the rare cases of aneurism which produce apoplexy when the brain is involved, and paralysis when the spinal marrow is affected.

The most common cause of rupture of vessels in the brain, is produced by an inflammation of a portion of its substance extending to the vessels, which give way, or the severer symptoms of apoplexy are produced by the effusion of blood; such as the sudden abolition of the organs of motion, accompanied with stertorous breathing, flushed livid countenance, immobility of the eye, foaming at the mouth and grinding of the teeth, dilated pupils, and resolution of the sphincter muscles, while the circulation is but slightly affected. By judiciously relieving the volume and force of the blood, while the powers of the system are sustained, the patient may in a certain degree recover, by nature removing the effusion, or preventing its influence on the organ, as exemplified in the fol-

lowing dissection :—The body was that of an elderly female, which presented nothing particular in the chest and abdomen. There was a considerable turgessence of the veins of the head, and a deposit of a gelatinous-looking fluid under the arachnoid coat, particularly towards its posterior side. On cutting through the hemisphere, there was an unusual appearance of bloody points in the medullary substance of the brain ; and on removing the cerebrum, a quantity of black-looking granular matter was discharged from its inferior and middle surface, exterior to the thalami nervorum opticorum, and the external and inferior part of the corpus striatum had a well-defined, regular cavity, with yellowish walls, exterior to which the brain appeared healthy. This cavity had been the result of a previous apoplectic effusion of blood, which had been converted into a dark-brownish fluid. In this case, the effects of the first attack had only been partially repaired.

On dividing the pons varoli, a recent effusion of blood was found, between the bundles of fibres of which that body is composed ; which had produced the sudden and fatal attack.

The *spinal marrow* is not unfrequently attacked with local inflammation of its substance, which changed from a yellowish tinge to a dark-brownish hue. In such cases, the first symptoms are of excitement, which are followed by those of collapse ; and this is sometimes produced by a softening of the capillary vessels of the part, and an effusion of blood into its substance.

b. Nasal Epistaxis often occurs at the age of puberty, and prevents dangerous diseases of the brain, produced by a determination of blood to that organ.

c. Pulmonary Apoplexy.—This complaint is generally sudden in its invasion, and is indicated by dyspnœa approaching suffocation. The movements of the thorax are quick and irregular, with great anxiety. At particular points, the crepitating and mucous rale are very distinct. As the disease advances in its course, the mucous rale is heard over a larger extent of surface ; and towards the termination of the disease the sounds of the chest become duller.

On dissection, circumscribed portions of the lungs are found of a dull red colour, which is not removed by washing, and of a dense consistence. On dividing these parts, small clots, or consolidated portions of blood are generally found, while the surrounding substance of the lung is pale and crepitating.

Hæmoptysis is usually produced by an exhalation of arterial blood from the mucous membrane of the air passage.

d. Abdominal Hemorrhage embraces hæmatemesis and bloody flux.

An attack of hæmatemesis is usually ushered in by anxiety, lassitude, and pain in the epigastrium, followed by vomiting of dark-coloured blood, mixed with such matter as may be in the stomach at the time. The stools also become of a dark colour, from the admixture of blood.

Such an evacuation of blood is known to come from the stomach, from its mixture with the contents of the stomach, and not being of a florid colour, mixed with air, or ejected during a fit of coughing.

Dissection exposes the mucous membrane of the stomach covered with red, brown, or black spots, and the vessels enlarged and gorged with blood. The hemorrhage in general appears to be the effect of exhaustion, and no vessels can be detected ruptured.

Bloody Flux is a frequent concomitant with some diseases, particularly of tropical climates.

e. Uterine Hemorrhage.—The uterine vessels which, during so many years of the life of the female, secrete a sanguineous fluid, in a state of disease exude blood. This is often in such quantities, and so frequently repeated, as to weaken the person, and if not arrested, will often ruin the constitution, or endanger her life. The weakness and relaxation produced by a long residence in a tropical climate, is a frequent cause of this distressing form of disease, and indicates the plan of treatment to be pursued.

SECTION III.

Changes in the Form of Capillary Vessels.

These changes may be *temporary*, as when the circulation is increased in a part by a vital or a mechanical cause ; or *permanent*, as in erectile tumours, aneurism by anastomosis, and piles.

1. The temporary enlargement of capillary vessels takes place on the formation of new parts, or to the uterus in pregnancy, or when there is an increased secretion, as of the mamma after parturition. It is by the same enlargement of vessels that the collateral circulation is carried on, when the principal artery of a member

has been obliterated by the encroachments of diseased structure, or by the bold operations of surgery, which distinguish the present advanced stage of English surgery. These operations prove that the trunks of arteries may be tied without injuring the nourishment or functions of the organs it supplies—the circulation being carried on by the enlargement of the anastomosing vessels of the same or of the opposite side of the body. We thus possess a great power over the diseased portions of the vascular system.

2. *Permanent enlargement of the capillary vessels.*—The vessels nearest the heart, and more vital tissues, will be less affected by external influences than those which are less vital, and more out of the course of the circulation. This is explained by the vitality acting in resisting such influences: in paralytic limbs the veins remain distended, from not being able to empty themselves of their contents; and priapism occurs in cases of injuries to the spinal marrow, from the cavernous tissue not being able to expel its contents in its state of weakness.

Erectile tumours may be a natural or morbid structure; may be a congenital formation, or acquired in after life, or may be circumscribed or diffuse, being formed of an irregular contractile cellular tissue, which is often increased to a considerable size. The tumour is generally of an irregular figure, of a dark red colour, and has usually a thrill from the neighbouring arteries, which are obstructed in the free passage of their contents. By pressure, the swelling of the erectile tumour may be removed. These tumours may form in the subcutaneous cellular tissue, or in the substance of organs. I have found them in the liver half an inch square. Externally, it had a dark bluish colour; and on dividing the tumour, it was found immediately under the peritoneal covering of the organ, and was filled with dark blood. On this being squeezed out, a reticulated appearance was left. In most other organs these morbid tumours are occasionally found in their substance.

The *erectile tissue*, or *nævi materni*, are morbid enlargements of the capillary vessels, particularly the capillary veins of a part, with a portion of intermediate areolar tissue. They have thus the exact anatomical structure of the natural erectile tissue; and it may be congenital or acquired. It more frequently occurs when many vessels inosculate freely with each other, as in the lips, &c. Such

tumours are more or less circumscribed in their extent, and have an irregular cellular appearance, as if made up of enlarged vessels. These tumours appear of different sizes, colours, and structure. Some resemble stains, others appear to be partial thickenings of the retemucosum, of a light brown, purplish red, livid, or nearly black colour. On examining these morbid structures with more care, they are found to consist of thickened cellular membrane, with large convoluted anastomosing veins, which form sacs in their course. In such cases of nævus, the arterial system is natural, and the coats of the veins thin, and communicate by foramena with each other ; so that they resembled the structure of the spleen, had not sufficient power to return the blood which accumulated in the veins ; and those in the vicinity gradually assumed the same diseased state. The ordinary nævi convert the neighbouring cellular tissue into cysts or capsules, and put a check on their farther increase.

The progress of these tumours is very different. Sometimes they are stationary for years. In others they become irritable, and of a florid red colour, when exposed to the exciting causes.

Such erectile tumours are found more frequently occupying the extremities of veins, than aneurism by anastomosis; and is distinguished from this by being softer, so as to admit of the blood being squeezed out of it, and by not pulsating. These erectile tumours are very rarely cured naturally; but have always a tendency to increase in size, and to bleed. When left to themselves, a clot forms round the bleeding aperture, by which the hemorrhage continues, and sometimes destroys the individual. In such cases various means have been recommended to repress these hemorrhages, which are less dangerous when the tumour is circumscribed, as they are more under control, and can be removed by the knife with less danger to the patient, by dividing the parts exterior to the tumour. But this operation is very rarely required, and when large they should seldom be attempted. In a case of this kind, Weinbold of Halle removed one which occupied the whole side of the face, and stopped the hemorrhage by the application of the actual cautery. The patient was cured in six weeks.* Other

* Salzb. Med. Chir. Zerb. 1820, v. 1, p. 352. See also, Lamonier Mem. de la Soc. de Montp. t. i. p. 245 ; Pott's Surgical Works, v. 3 ; Pelletan Clin. Chirur., t. ii. p. 37 ; Scarpa, Trat. on Hernia.

surgeons have proposed to pass a platinum wire through the tumour, and heat it by galvanism; or to apply the perchloride of iron, which reduce the blood into a dead coagulum. These produce the irritation necessary to cause a consolidation in the neighbouring vessels; which, however, is better done by directly irritating the surface, as by the application of the nitrate of silver, potassa fusa, or, still better, by one or more blisters; and by these means, consolidating the contents of the tumour, and so arresting the disease.

Torebut, æt. 30, noticed, two months ago, a small erectile tumour on the side of the nose. It appeared without any apparent cause, and was at first small, irregular in shape, of a red colour, and without pain. It gradually increased in size during a month, when it had reached the size of a pea; and there is now a daily discharge of an ounce of blood. When I saw it, a scab covered the opening in the tumour, and on removing it, and pressing the tumour, the bleeding was renewed. In this case I applied freely the nitrate of silver over its surface, and two days after I found the swelling had sunk, and no return of the hemorrhage had taken place. Another application completed the cure.

*Aneurism from anastomosis** is chiefly an enlargement of the capillary arteries; and is most commonly seen in the young when the arterial system is very active, and in females, who are more liable than men to congestions of blood. They appear in different parts of the body, but particularly on the head.

This morbid change is sometimes first observed in the infant, in the form of a small red mark, which often continues stationary through life. In some cases it suddenly enlarges in size, becomes of an irregular figure, which is elastic and compressible, but quickly returns to its former size, when the compression is removed. In some rare cases these tumours diminish, and almost disappear.

The pain of these tumours is often dull and peculiar, with an undulatory motion, which becomes a throbbing pulsatory thrill, and in other cases the pain is most acute. When pressure can be made upon the artery supplying the tumour, its tremulous motion ceases, and the swelling lessens.

* Of John Bell (Prin. of Surgery, vol. ii. p. 456.) *Tumeur Sanomatices* of A. Petit; *aneurismé varequeux alangustasi* of Grœfe (De Ratione et Cura-Angiectasie, Lep. 1807); *Trichocerseos* of Dzondi; *tumeur érectile* of Dupuytren; *tumeur fongeuse sanguin congenitale* of Boyer; and *fongus hæmatodes* of Maurosi.

These morbid appearances are produced by a general weakness of the tissue of the capillary vessels of the part, especially of the arteries, which are morbidly enlarged, forming circumscribed tumours of different sizes, which slowly form, and frequently rapidly increase, and have a constant throbbing sensation. Unlike aneurism in trunks, which resists control as it acquired strength, these tumours may be retarded in their growth by being properly supported. When the circulation of blood is rapid through such morbid parts, the blood is of an arterial colour; but when the branches which feed it are of a smaller size, the circulation is less rapid, and the blood has a darker, or more venous appearance.

Sometimes these tumours remain stationary for long periods, and in other cases they increase in size rapidly. Commencing from a point, they sometimes extend over the whole side of the head, an extremity, or even one side of the body.* Any exertion deepens the colour, and increases the size of the tumour. When from emotions of the mind, or other causes irritating the part, the vessels become turgid, it throbs violently, becomes irregular in its figure, purple spots or small tumours appear on the most prominent points, from which effusions of blood sometimes take place into the neighbouring cellular tissue. The veins of the neighbourhood are engorged with blood, from the absence of the usual propelling force of the capillary arteries, which render the circulation in the part slower than natural. Such is the engorged state of the vessels in these cases, that some of them occasionally burst, followed by hemorrhage. This is often checked with difficulty, and repeated so often as to weaken, and eventually destroy the individual.

When the progress of the tumour is slower, its appearance and colour vary considerably. The skin covering it is of a darker or more florid red colour, and from its increased vitality, its tissue is more developed, the surface of the skin becomes more irregular, and its appendages stronger.

On dissection the arteries are found very large in the tumour, and terminate in sacculi, which form a structure like an erectile tissue.

As it frequently occurs that these erectile tumours remain stationary for long periods, and often do not enlarge during the person's lifetime, it is usually better not to meddle with them unless, when they enlarge, or, from their position, require to be

* Abernethy's Works, vol. ii. p. 230.

removed. In such cases the *treatment* to be employed is various, and will be considered under the heads of compression, excision, or ligature.

a. There are a few cases in which the continued methodical *compression* of the tumour may be successfully employed; as in this case such a degree of irritation would be produced in the tumour, and such a retardation of blood as to produce a consolidation in the diseased vessels, and thus accomplish a cure.* Mr. Abernethy recommends the many-tailed bandage, made with adhesive plaster, to be applied to the tumour, which diminishes the heat and sensibility of the tumour, by the diminished quantity of blood it receives. This bandage must be continued for four, six, or more months, according to the circumstances of the case. When the quantity of blood sent to the part cannot be reduced by pressure alone, cold, &c. may be added. In a case of this disease in the eye of an infant, a cure was obtained by the application of lint wet with rose water, saturated with alum. This application was continued for three months.† We shall find that the application of irritants to the tumour are the most speedy, certain, and simple means of cure.

b. In *excising* such aneurismal tumours, it is necessary to remove the part at some distance from the disease, in consequence of the very large size of the vessels in the tumour, which often yields so much blood as to destroy the person immediately when cut into. As it is often impossible to know the extent of the disease, the operation is always attended with danger when the disease is not well defined, and is now found very rarely to be required.

c. The third means to be employed for curing aneurism from anastomosis is by the *ligature*. This may be done by tying the trunk feeding the tumour, by which the direct impetus of the blood is stopped; and although the beating of the tumour may continue from the collateral circulation, it allows the diseased vessels to contract, and the tumour disappears. Messrs. Travers,‡ Dalrymple,§ and Wardrop,‖ have employed this method with suc-

---

* Pelletan, Chir. Clin. tom. ii. p. 68. Boyer Mal. Chirur. tom. ii. p. 203. Roux Parill de la Chir. Française et Ang. p. 250.

† Abernethy's Works, v. ii. p. 235.   ‡ Med. Chir. Trans., vol. ii.
         § Ib. vol. vi.   ‖ Ib. vol. ix.

cess; and it is applicable when the disease is so extensive as to preclude the employment of other means of cure. In such cases two double ligatures are to be passed across each other under the tumour, and tied, first gently, and then firmly, so as to destroy the vitality of the part. By allowing the ligatures to remain four hours is quite sufficient to consolidate the blood in the tumour. This dries up, and forms a shrivelled mass; which in the course of twelve or fourteen days drops off, without any suppuration or open sore, leaving a small scar.

When the tumour is small and circumscribed, I have seen Mr. Lawrence, in several cases, pass a long needle with a strong double ligature through the base of the tumour, and tie the ligatures very tight, above and below. This method may be employed even when the whole disease cannot be included in the ligature, as the irritation of this produces a consolidation and obliteration of any diseased vessels that may be situated near it.

The method by compression and by ligature, often accomplishes a cure, by the irritation they produce in the tumour, consolidating the blood; but this effect may be more readily accomplished by the application of caustics, blisters, and other such stimulants. These applications must be varied with the extent of the tumour, and other individual circumstances, such as retarding the blood by pressure upon the arteries supplying the tumour, when the circulation is too active for the ready consolidation of their contents; and by such modifications, a cure may generally be accomplished, without having recourse either to the knife, or the ligature.

ENCYCLOPÆDIA BRITANNICA,

EIGHTH EDITION.

Now Publishing in Monthly Parts, price 8s.,

AND

Quarterly Volumes, price 24s.

———◆———

LIST OF SOME OF THE CONTRIBUTORS.

THE RIGHT HONOURABLE LORD MACAULAY.

Right Rev. RICHARD WHATELY, D.D., Archbishop of Dublin.

Right Rev. R. DICKSON HAMPDEN, D.D., Bishop of Hereford.

WILLIAM WHEWELL, D.D., Trinity College, Cambridge.

Sir DAVID BREWSTER, K.H., LL.D., Principal of the United Colleges of St. Salvator and St. Leonard, St. Andrews.

RICHARD OWEN, Esq., F.R.S.

JOHN LEE, D.D., Principal of the University of Edinburgh.

Sir WILLIAM HAMILTON, Bart.

Sir ARCHIBALD ALISON, Bart.

Sir JOHN RICHARDSON.

Sir JOHN M'NEILL.

HENRY ROGERS, Esq., Author of the "Eclipse of Faith," &c.

ISAAC TAYLOR, Esq., Author of the "Natural History of Enthusiasm," &c.

Rev. CHARLES KINGSLEY, Author of "Hypatia," "Westward Ho," &c.

J. D. FORBES, Professor of Natural Philosophy in the University of Edinburgh, &c. &c.

ROBERT STEPHENSON, Esq., M.P., President of the Institution of Civil Engineers, &c.

RICHARD MONCKTON MILNES, Esq., M.P.

HEPWORTH DIXON, Esq.

THEODORE MARTIN, Esq.

COLONEL PORTLOCK, R.M.A., President of the Geological Society of London.

DAVID MASSON, M.A., Professor of English Literature in University College, London.

Sir JOHN F. W. HERSCHELL, Bart., K.H., M.A., D.C.L., &c.

D. F. ARAGO, late Member of the Royal Institute of France.

JOHN ROBISON, LL.D., late Professor of Natural Philosophy in the University of Edinburgh.

Sir WALTER SCOTT, Bart.

C. C. J. BUNSEN, D.D., D.C.L., D.P.H.

Lord JEFFREY.

THOMAS YOUNG, M.D., late Corresponding Member of the Royal Institute of France.

Sir JOHN LESLIE, late Professor of Natural Philosophy in the University of Edinburgh.

Sir JOHN BARROW, Bart.

JOHN PLAYFAIR, F.R.S., late Professor of Natural Philosophy in the University of Edinburgh.

The Right Hon. Sir JAMES MACKINTOSH, LL.D., &c.

DUGALD STEWART, F.R.SS. L. and E.

Sir JAMES E. SMITH, F.R.S., late President of the Linnean Society.

JEAN BAPTISTE BIOT, Member of the Royal Institute of France.

Right Rev. GEORGE GLEIG, D.D.

Lieut.-Col. CHARLES HAMILTON SMITH, F.R.S.

E. G. SQUIER, formerly Chargé D'Affaires of the United States to the Republics of Central America.

Sir John Graham Dalyell, Bart.

Robert Jameson, F.R.S., late Regius Professor of Natural History in the University of Edinburgh.

Alan Stevenson, Esq., F.R.S.E., C.E.

Edward Edwards, Esq.

John Crawfurd, Esq., F.R.S., Author of "A Descriptive Dictionary of the Indian Islands."

J. Y. Simpson, M.D., Professor of Midwifery in the University of Edinburgh.

Thomas de Quincey, Esq.

R. G. Latham, Esq., M.A., M.D., &c.

W. E. Aytoun, Professor of Rhetoric and Belles Lettres in the University of Edinburgh.

J. R. M'Culloch, Esq., Member of the Institute of France, &c.

Augustus Petermann, Esq., F.R.G.S., &c.

William Spalding, M.A., Professor of Logic and Metaphysics in the University of St. Andrews.

Rev. J. E. Ryland, M.A., &c.

Rev. P. Kelland, M.A., Professor of Mathematics in the University of Edinburgh.

Antonio Panizzi, Esq.

Thomas Anderson, M.D., Professor of Chemistry in the University of Glasgow.

Dr. Doran, Author of "Habits and Men," &c.

William Fairbairn, Esq., C.E., Manchester.

H. L. Mansel, Reader in Moral and Metaphysical Philosophy, Magdalen College, Oxford.

James Caird, Esq., Author of "English Agriculture in 1850-51," &c.

Thomas Laycock, M.D., Professor of the Practice of Physic in the University of Edinburgh.

Daniel Wilson, LL.D., F.R.S.A., &c.

Lawrence Oliphant, Esq., Author of the "Russian Shores of the Black Sea."

George Farquhar Graham, Esq.

John Fleming, D.D., Professor of Natural Science, New College, Edinburgh.

E. B. Denison, Esq., M.A., Q.C., &c.

Rev. John Cairns, M.A.

J. H. Balfour, M.D., Professor of Botany in the University of Edinburgh.

J. S. Blackie, Professor of Greek in the University of Edinburgh.

James Montgomery, Esq., Author of "Greenland and other Poems," &c.

Sir Benjamin Pine.

Dr. Sandwith, K.B.

William Gregory, M.D., Professor of Chemistry in the University of Edinburgh.

George Wilson, M.D., Professor of Technology in the University of Edinburgh.

Rev. William Scoresby, LL.D., &c.

Robert Carruthers, Esq.

John Hill Burton, Esq.

J. B. Jukes, Esq., M.A., Vice-President of the Geological Society of Dublin.

William Hosking, Professor of Arts and Construction, King's College, London.

Alexander Smith, Esq., Author of "A Life Drama," &c.

Rev. William Hanna, LL.D.

Rev. Robert Main, M.A., F.R.A.S., &c.

John Tulloch, D.D., Primarius Professor of Divinity, St. Andrews.

Charles Maclaren, Esq., F.R.S.E., &c.

J. L. Ricardo, Esq., M.P.

Leonhard Schmitz, LL.D., F.R.S.E., &c.

Edward Thornton, Esq., Author of "Gazetteer of India," &c.

George Ferguson, LL.D., Professor of Humanity, King's College, Aberdeen.

James Pillans, M.A., Professor of Humanity in the University of Edinburgh.

F. Crace Calvert, Professor of Chemistry, Royal Institution, Manchester.

Robert Christison, M.D., Professor of Materia Medica in the University of Edinburgh.

R. S. Poole, Esq., M.R.S.L., &c.

John Barrow, Esq., Admiralty.

Joseph D. Hooker, M.D., R.N.

Charles Tomlinson, Esq., Editor of a "Cyclopædia of Useful Arts," &c.

W. L. Alexander, D.D.

Thomas Bazley, Esq., Chairman of the Chamber of Commerce, Manchester.

W. H. Langley, Esq., Editor of "Bell's Life in London."

Charles Mackintosh, Esq., Author of the "Book of the Garden."

T. C. Archer, Esq., Author of "Popular Economic Botany."

J. P. Lacaita, Esq.

Arthur Ashpitel, Esq.

A. V. Kirwan, Esq.

William Blair, Esq., Author of "Inquiry into Slavery amongst the Romans," &c.

Robert Chambers, Esq.

Rev. Richard Waterston, M.A.

ENCYCLOPÆDIA BRITANNICA.

EIGHTH EDITION.

PRINCIPAL SUBJECTS.

VOLUME I.

DISSERTATION FIRST.— *On the Progress of Metaphysical and Ethical Philosophy, since the Revival of Letters in Europe.* By DUGALD STEWART, late Professor of Moral Philosophy in the University of Edinburgh.

DISSERTATION SECOND.—*On the Progress of Ethical Philosophy, chiefly during the Seventeenth and Eighteenth Centuries.* By Sir JAMES MACKINTOSH, LL.D. With a Preface by WILLIAM WHEWELL, D.D.

DISSERTATION THIRD.—*On the Rise, Progress, and Corruptions of Christianity.* By RICHARD WHATELY, D.D., Archbishop of Dublin.

DISSERTATION FOURTH.—*On the Progress of Mathematical and Physical Science since the Revival of Letters in Europe.* By Sir JOHN PLAYFAIR, late Professor of Natural Philosophy in the University of Edinburgh.

DISSERTATION FIFTH.— *On the Progress of Mathematical and Physical Science, chiefly during the Eighteenth Century.* By Sir JOHN LESLIE, late Professor of Natural Philosophy in the University of Edinburgh.

DISSERTATION SIXTH. — *On the Progress of Mathematical and Physical Science during the Nineteenth Century.* By JAMES D. FORBES, Professor of Natural Philosophy in the University of Edinburgh.

VOLUME II.

ABERRATION & ACOUSTICS. By GEORGE BUCHANAN, F.R.S.E.

ACHROMATIC GLASSES and AERONAUTICS. By Sir JOHN LESLIE.

ADMIRAL and ADMIRALTY. By Sir JOHN BARROW, Bart. Revised by JOHN BARROW, Admiralty.

ADDISON (JOSEPH). By WILLIAM SPALDING, A.M., Professor of Logic in the University of St. Andrews.

ÆSCHYLUS. By J. S. BLACKIE, Professor of Greek in the University of Edinburgh.

ÆTNA and ALPS. By ROBERT JAMESON, late Professor of Natural History in the University of Edinburgh.

AFGHANISTAN. By DAVID BUCHANAN and EDWARD THORNTON, East India House.

AFRICA. By AUGUSTUS PETERMANN, F.R.G.S.

AGRICULTURE. By J. WILSON, Eddington Mains, Berwickshire.

AGRICULTURAL CHEMISTRY. By THOMAS ANDERSON, M.D., Professor of Chemistry in the University of Glasgow.

AGRARIAN LAWS. By GEORGE FERGUSON, Professor of Humanity, King's College, Aberdeen.

VOLUME V.

BOOKBINDING. By CHARLES MARTEL.

BOMBAY, BURMAH, etc. By ED. THORNTON, East India House.

BOOK-KEEPING. By JOSEPH LOWE.

BORNEO and BORNOU. Revised by AUGUSTUS PETERMANN, F.R.G.S., etc.

BOTANY. By JOHN HUTTON BALFOUR, M.D., Professor of Botany in the University of Edinburgh.

BRAHMINS. By JAMES BROWNE, LL.D.

BRASS. By CHARLES SYLVESTER, C.E.

BRAZIL.

BREAKWATER. By Sir JOHN BARROW, Bart. Revised by JOHN BARROW, Admiralty.

BREWING. By JAMES STARK, M.D., F.R.S.E.

BRICKMAKING. By SAMUEL HOLMES, Liverpool.

BRIDGE. By THOMAS YOUNG, M.D., F.R.S.

BRITAIN. By JAMES BROWNE, LL.D., with Continuation.

BRUCKER. By Sir WILLIAM HAMILTON, Bart.

BUILDING. By WILLIAM HOSKING, Author of "Architecture."

BUNYAN. By the Right Hon. THOMAS BABINGTON MACAULAY.

BURMAH. By D. BUCHANAN and E. THORNTON. -

VOLUME VI.

BUTLER (BISHOP.) By HENRY ROGERS, Author of the "Eclipse of Faith," etc.

BURNING-GLASSES. By GEORGE BUCHANAN, F.R.S.E.

CALENDAR. By THOMAS GALLOWAY, F.R.S.

CALIFORNIA.

CALVIN and CHANNING. By Rev. W. L. ALEXANDER, D.D.

CAMPBELL, THOMAS. By W. E. AYTOUN, Professor of Rhetoric and Belles Lettres in the University of Edinburgh.

CANADA. By J. B. BROWN, Author of "Views of Canada."

CANARY ISLANDS. By J. Y. JOHNSON, Madeira.

CANNON. By Colonel PORTLOCK, Woolwich.

CAPILLARY ACTION. By JAMES IVORY, F.R.S.

CARTHAGE. By JAMES BROWNE, LL.D., and Dr. SCHMITZ.

CARPENTRY and CHROMATICS. By THOMAS YOUNG, M.D.

CAVAN and CLARE. By HENRY SENIOR.

CENTRE. By JOHN ROBISON, late Professor of Natural Philosophy in the University of Edinburgh.

RELIGIOUS WORKS.

Kitto's Cyclopædia of Biblical Literature. A New
Edition, Edited by the Rev. HENRY BURGESS, LL.D., Ph. D., of Kitto's Cyclo-
pædia of Biblical Literature, compiled by the late JOHN KITTO, D.D., with the
assistance of numerous able Scholars and Divines, British, Continental, and
American, whose Initials are affixed to their respective contributions. 2 vols.
medium 8vo; with a complete Index, and upwards of 554 Illustrations. Price £3.

The following Branches of Knowledge are comprised in the Work:—

1. BIBLICAL CRITICISM—Embracing the History of the Bible Languages—
   the Canon of Scripture—Literary History and Peculiarities of the Sacred Books
   —Formation and History of the Texts of Scripture.

2. BIBLICAL INTERPRETATION—Comprehending the Principles of Trans-
   lating and Expounding Scripture—Critical Estimate of the leading Interpreters
   and principal Versions, Ancient and Modern.

3. HISTORY—Proper Names of Persons—Biographical Sketches of the more pro-
   minent Characters—Detailed Accounts of the Principal Events recorded in
   Scripture—Chronology and Genealogy of Scripture.

4. GEOGRAPHY—Names of Places—Description of Scenery—Boundaries and
   Mutual Relations of the Countries mentioned in Scripture, so far as necessary
   to illustrate the Sacred Text.

5. ARCHÆOLOGY—Manners and Customs of the Jews, and other Nations men-
   tioned in Scripture—their Sacred Institutions—their Military Affairs—their
   Political Arrangements—their Literary and Scientific Pursuits.

6. PHYSICAL SCIENCE—Scripture Cosmogony and Astronomy—Zoology—
   Mineralogy—Botany—Meteorology.

"Among the contributors are to be recognised the names of many of the most
distinguished Biblical Scholars, both British and Foreign. It is not, therefore,
too much to say, that this *Cyclopædia* surpasses every Biblical Dictionary which
has preceded it, and that it leaves nothing to be desired in such a work which
can throw light on the Criticism, Interpretation, History, Geography, Archæology,
and Physical Science of the Bible."—*Horne's Introduction to the Critical Study of the
Scriptures.*

Kitto's Popular Cyclopædia. A Popular Dictionary
of the Bible. By JOHN KITTO, D.D. In One Volume 8vo, Illustrated by 856
Engravings on Wood. Price 10s. 6d.

Kitto's Palestine. The History of Palestine from
the Patriarchal Age to the Present Time. By JOHN KITTO, D.D. Profusely
Illustrated, crown 8vo; cloth plain 6s., cloth gilt edges 6s. 6d.

"Beyond all dispute it is the best historical compendium of the Holy Land,
from the days of Abraham to those of the late Pasha of Egypt, Mehemet Ali."—
Observer.

"Not only a complete description of the Holy Land, but a condensed History of
the Jewish People."—*John Bull.*

"No expense seems to have been spared in the getting up of this volume."—
Britannia.

Davidson's Biblical Criticism. A Treatise on

Biblical Criticism, exhibiting a Systematic View of that Science. By SAMUEL DAVIDSON, D.D., of the University of Halle, and LL.D. One Volume 8vo. Price 18s.

"The present work bears marks of the same industry and learning which have distinguished the author's other productions.—*Bib. Sacra.*

"We have much pleasure in commending this volume to the notice of those for whose benefit it is intended."—*Witness.*

WARDLAW—*Memoirs of the Life and Writings of*

RALPH WARDLAW, D.D. By W. L. ALEXANDER, D.D. Second Edition, demy 8vo. Price 12s.

WARDLAW—*Ralph Wardlaw's Systematic Theology.*

A Complete System of Polemic Divinity. Edited by the Rev. J. R. CAMPBELL, M.A. 3 vols. demy 8vo. Price 12s. each.

GUTHRIE—*The Gospel in Ezekiel;* illustrated

in a Series of Discourses. By THOMAS GUTHRIE, D.D., Author of "Pleas for Ragged Schools." Twentieth Thousand, crown 8vo. Price 7s. 6d.

"Dr. Guthrie stands among the foremost preachers of the present day. His sermons unite a strain of lofty thought and burning sentiment with a boundless power of illustration, and a gorgeous imagination. Sound in doctrine, and endowed with a fervent jealousy for the honour of God and the integrity of His Word, he grapples boldly and successfully with the plausible arguments of modern infidelity, and vindicates with no common power the faithfulness, wisdom, and immeasurable love of God in the great scheme of saving grace."—*The Record.*

"Since Dr. Chalmers, no Scottish divine has produced sermons more eloquent and impressive than those contained in this volume. . . . Two or three extracts will show that this book is different from the ordinary pulpit style which has rendered 'a sermon' almost a synonym for any composition which is dull, formal, and unattractive."—*Literary Gazette.*

"He has long been acknowledged as the most brilliant of preachers. The present work will amply bear out his reputation in this respect. It is full of the noblest eloquence and richest poetry. It is the outpouring of a glorious imagination, sanctified, which adorns, but never overshadows, the truth. Indeed, for beautiful thought and glowing diction, we will confidently stake it against any production of the modern press."—*Caledonian Mercury.*

BY THE SAME AUTHOR,

The City, its Sins and Sorrows. Being a Series

of Sermons from Luke xix. 41. 15th Thousand, crown 8vo. Price 3s.

Christ and Christ Crucified. A Sermon on the

occasion of the death of WILLIAM M. GUNN, LL.D. Fourth Thousand, crown 8vo. Price 1s.

Berridge's Christian World Unmasked. New

Edition. Edited, and with Life of the Author, by THOMAS GUTHRIE, D.D. 12mo. Price 2s. 6d.

War, in some of its Social, Political, and Religious

Aspects. 12mo sewed. Price 1s.

BOWDLER— *The Religion of the Heart,* as exemplified

in the Life and Writings of JOHN BOWDLER, late of Lincoln's Inn, Barrister-at-Law. Edited by his brother, CHARLES BOWDLER. Foolscap 8vo. Price 5s.

D

SIR WALTER SCOTT'S WORKS.

•————

THE WAVERLEY NOVELS.

Six Editions as follows:

I.

Library Edition.   Illustrated by upwards of Two
Hundred Engravings on Steel, after Drawings by Turner, Landseer, Wilkie.
Stanfield, Roberts, etc., including Portraits of the historical Personages described
in the Novels. Complete in 25 volumes demy octavo, elegantly bound in extra
cloth, price £13 : 2 . 6.

II.

Abbotsford Edition.   With One Hundred and
Twenty Engravings on Steel, and nearly Two Thousand on Wood. In 12 vols.
super royal 8vo, price £14 : 14s.

III.

Author's Favourite Edition.   48 portable foolscap
8vo vols. (96 Engravings), price £7 : 4s.

IV.

Cabinet Edition.   25 vols. foolscap 8vo (26 Illus-
trations), £3 : 13 : 6.

V.

People's Edition.   5 large volumes royal 8vo,
£2 : 2s.

VI.

SEPARATE NOVELS, *People's Edition,* in beautifully
illuminated covers, price 1s. 6d. each, as follows:—

1. WAVERLEY.
2. GUY MANNERING.
3. ANTIQUARY.
4. ROB ROY.
5. OLD MORTALITY.
6. THE BLACK DWARF, AND LEGEND OF MONTROSE.
7. HEART OF MID-LOTHIAN.
8. BRIDE OF LAMMERMOOR.
9. IVANHOE.
10. MONASTERY.
11. ABBOT.
12. KENILWORTH.
13. PIRATE.
14. FORTUNES OF NIGEL.
15. PEVERIL OF THE PEAK.
16. QUENTIN DURWARD.
17. ST. RONAN'S WELL.
18. REDGAUNTLET.
19. BETROTHED AND HIGHLAND WIDOW.
20. THE TALISMAN.
21. WOODSTOCK.
22. FAIR MAID OF PERTH.
23. ANNE OF GEIERSTEIN.
24. COUNT ROBERT OF PARIS.
25. SURGEON'S DAUGHTER AND CASTLE DANGEROUS.

Separate Novels may also be had from any of the other Editions.

SIR WALTER SCOTT'S
MISCELLANEOUS PROSE WORKS.
CONSISTING OF

Tales of a Grandfather, (History of Scotland).	*Memoirs of Eminent Novelists, etc.*
Tales of a Grandfather, (History of France).	*Paul's Letters to his Kinsfolk.*
Life of John Dryden.	*Essays on Chivalry, Romance, and the Drama, etc.*
Memoirs of Jonathan Swift.	*Provincial Antiquities of Scotland.*
	Life of Napoleon Bonaparte.

Miscellaneous Criticisms, etc.

COMPLETE EDITIONS.

I. In Twenty-eight volumes Foolscap 8vo, with Fifty-six Engravings from Turner. Price £4 : 4s.; Separate volumes, 8s.

II. In Three volumes Royal 8vo. (PEOPLE'S EDITION.) Bound in cloth, price £1 : 6s. Separate Volumes, I. and II., 10s. each; III. (TALES OF A GRANDFATHER), price 6s.

Illustrated Edition of the TALES OF A GRANDFATHER—
    (HISTORY OF SCOTLAND). With Six Engravings after Turner, and upwards of Fifty on Wood. In Three volumes Foolscap 8vo, cloth, 12s.; extra, cloth, gilt edges, 15s.
    (HISTORY OF FRANCE.) With Two Engravings from Turner, and upwards of Fifty on Wood. One volume Foolscap 8vo, cloth, 4s. ; extra, cloth, gilt edges, 5s.

SCHOOL EDITION of the HISTORY OF SCOTLAND, with Map. In Two volumes, Crown 8vo, bound, 10s.

LIFE OF NAPOLEON BONAPARTE. Five volumes Foolscap 8vo, Maps, Portrait, and Nine Engravings after Turner. Cloth, price £1.

Another Edition in larger type. Nine volumes Foolscap 8vo, Maps, Portraits, and Engravings. Cloth, price £1 : 7s.

SELECTIONS FROM
SIR WALTER SCOTT'S WORKS.

BELGIUM AND WATERLOO.	CHARACTERS OF EMINENT PERSONS.
FRANCE AND PARIS.	THE HIGHLAND CLANS.
TALES OF CHIVALRY.	SCOTTISH SCENES AND CHARACTERS.
ROMANTIC NARRATIVES.	NARRATIVE AND DESCRIPTIVE PIECES.

Price Eighteenpence, or Two Shillings, Cloth.

BEAUTIES OF SIR WALTER SCOTT, BEING SELECTIONS FROM HIS WRITINGS AND LIFE. One volume, Crown Octavo, with Two Engravings. Cloth, gilt, 5s. ; extra cloth, gilt sides and edges, 6s.

The same volume bound as a School Book. Price 3s. 6d.

READINGS FOR THE YOUNG, FROM THE WORKS OF SIR WALTER SCOTT. In Three volumes, with Thirty-six Illustrations on Wood, price 2s. 6d. each; or bound in One volume, cloth, gilt edges, 7s.

SCOTT'S POETICAL WORKS.

CONSISTING OF

First, The Metrical Romances,—THE LAY OF THE LAST MINSTREL; MARMION; THE LADY OF THE LAKE; ROKEBY; THE LORD OF THE ISLES; THE VISION OF DON RODERICK; THE BRIDAL OF TRIERMAIN; and HAROLD THE DAUNTLESS.

Second, Dramas, Songs, and Ballads.

Third, The Minstrelsy of the Scottish Border.

The following are the only COPYRIGHT EDITIONS, with the AUTHOR's LAST NOTES and IMPROVEMENTS.—

I. In One portable Foolscap volume, including all the Metrical Romances (except the Bridal of Triermain and Harold), the Principal Songs and Ballads, and several Illustrations. Bound in cloth, gilt edges, price 5s.; or morocco antique, 10s.

II. In One Crown octavo volume (same contents as previous Edition), with numerous Engravings on Steel and Wood, after Turner, Gilbert, and Foster. Bound in cloth, gilt edges, 7s. 6d.; morocco antique, 14s.

III. In Twelve volumes. Foolscap 8vo (24 Engravings), £1 : 16s. *This is the only Edition which contains the Minstrelsy of the Scottish Border.*

IV. In Six volumes. Foolscap 8vo (12 Engravings), £1 : 4s.

V. In One volume. Royal 8vo (PEOPLE'S EDITION), 10s.

VI. The ABBOTSFORD EDITION, printed on Tinted Paper, with upwards of Sixty Illustrations on Steel and Wood, after Turner, Gilbert, and Foster. Elegantly bound in extra cloth, gilt edges, price £1 : 11 : 6; morocco elegant or antique, £2 : 2s.

VII. TOURISTS' EDITIONS of THE LAY OF THE LAST MINSTREL, MARMION, LADY OF THE LAKE, LORD OF THE ISLES, ROKEBY, and BRIDAL OF TRIERMAIN, 1s. 3d. each; 1s. 6d. cloth; or 2s. 6d. morocco, gilt edges.

VIII. New Illustrated Editions of THE LADY OF THE LAKE, MARMION, LAY OF THE LAST MINSTREL, and LORD OF THE ISLES, containing each from Seventy to One Hundred Illustrations on Wood, by Birket Foster and John Gilbert. Printed in the best style, on Tinted Paper, and elegantly bound in cloth, gilt edges, price 18s. each; morocco, elegant or antique, £1 : 5s.; enamelled tartan boards, £1 : 16s.

LIFE OF SIR WALTER SCOTT,

BY J. G. LOCKHART, ESQ.

THREE EDITIONS AS FOLLOWS :—

I.

In Ten volumes Foolscap 8vo, uniform with the Author's Favourite Edition of the Novels. Twenty Engravings on Steel, price £1 : 10s.

II.

In One Vol. royal 8vo, uniform with the Novels, PEOPLE'S EDITION. With Portrait, price 10s.

The same, Large Paper, uniform with the Novels, ABBOTSFORD EDITION. With Eleven Engravings from Turner, Portraits, &c., price 18s.

III.

In One vol. Crown 8vo, with Twelve Engravings from Turner and Others. Price 7s. 6d.; extra, cloth, gilt edges, 8s. 6d.

WORKS ON GARDENING AND BOTANY.

I.

ADAMSON. — *The Cottage Garden.* By ROBERT
ADAMSON. 12mo, price 2s. Second Edition.

II.

NEILL. — *Neill's Fruit, Flower, and Kitchen
Garden.* Fifth Edition, improved, with Additions, price 5s.

" In Horticultural Literature, no book has acquired a higher reputation than the late Dr.
Neill's concise and popular treatise on Practical Gardening. It is copiously illustrated;
and no gardener, be he amateur or professional, great or small, whether he grows
pines or only potatoes, should be without it."—*Morning Post.*

III.

BURGESS.—*The Amateur Gardener's Year-Book :*
A Guide for those who cultivate their own Gardens in the Principles and Practice
of Horticulture. By the Rev. HENRY BURGESS, LL.D. and Ph. D., &c. &c.
Fcap. 8vo, price 5s., with Illustrated Frontispiece and Title.

" This is, beyond compare, the best work of its class that has come under our notice. It
is really popular."—*Critic.*

" Contains a great deal of valuable information in laying out gardens, and keeping a suitable
succession of flowering plants and shrubs."—*Atlas.*

IV.

BALFOUR.—*Outlines of Botany :* Being an Intro-
duction to the Study of the Structure, Functions, Classification, and Distribution
of Plants. With a Glossary and Copious Index. By JOHN HUTTON BALFOUR,
M.D., F.R.S.L. and E., F.L.S., Professor of Botany in the University of Edin-
burgh. Fcap. 8vo, 7s. 6d., illustrated by 595 Wood Engravings.

V.

BALFOUR.—*Class-Book of Botany :* Being an In-
troduction to the Study of the Vegetable Kingdom. By J. H. BALFOUR, M.D.,
F.R.S.L. and E., Regius Keeper of the Royal Botanic Garden, Professor of Medi-
cine and Botany in the University of Edinburgh. In one large Volume 8vo,
with 1800 Illustrations, price 31s. 6d.

The same may also be had in Two Parts.

PART I.—STRUCTURAL AND MORPHOLOGICAL BOTANY, 8vo, 10s. 6d.

PART II.—COMPRISING THE ELEMENTS OF VEGETABLE PHYSIOLOGY,
CLASSIFICATION, BOTANICAL GEOGRAPHY, AND FOSSIL
BOTANY, WITH A GLOSSARY OF TERMS. 8vo, 21s.

" Few, if any, works on this subject, contain such a mass of carefully collected and condensed
matter, and certainly none are more copiously, or, on the whole, better illustrated."—
Hooker's Journal of Botany, Jan. 1853.

" The best and most interesting introduction to the Study of Botany, that has ever come into
our hands."—*North British Agriculturist.*

" A good useful Class-Book, illustrated with numerous Woodcuts."—*Gardener's Chronicle.*

" One of the best books to place in the hands of a student."—*Annals of Natural History.*

" One of the most complete and elegant class-books on Botany which has been published.
It contains all that a student may require, both in description and illustration."—
Lancet.

ATLASES.

I.

General Atlas of the World. — Containing up-
wards of Seventy Maps, engraved on Steel, in the first Style of the Art, by
HUGHES, BARTHOLOMEW, and others; with Introductory Chapters on the Geo-
graphy and Statistics of the different Countries in the World, and an Index of all
the Names occurring in the several Maps, amounting to 60,000, with their Lati-
tude and Longitude, and the number of the Map in which they will be found.
New Edition, with numerous improvements and additions. Strongly and elegantly
half-bound in morocco, with gilt leaves, £2 : 16s.

II.

Atlas of North America, with Maps of the various
Provinces, States, and Countries of that Continent, and Plans of the City of New
York, the Environs of Montreal, and Panama Railway. Constructed from the
most recent authorities. By JOHN BARTHOLOMEW, F.R.G.S.

PRINCIPAL CONTENTS.

No. I. North America. II. British, Russian, and Danish America—Polar Regions.
III. Upper Canada. IV. Lower Canada, New Brunswick. V. to XVIII.
Separate States and Territories of the United States. XIX. Mexico, Central
America, and West Indies. XX. Steamer Routes and Oceanic Currents. With
descriptive Letterpress, and an Index of 21,000 Names. Imperial Folio, 16s.

III.

Hand-Atlas of Modern Geography. A Series of
Thirty-Eight Maps. By WILLIAM HUGHES, F.R.G.S.; and JOHN BARTHOLO-
MEW, F.R.G.S. With a Complete Index of Names. Quarto, half-bound, 21s.

IV.

School Atlas of Modern Geography. New Edition.
A Series of Thirty-Seven Maps, for Instruction in Physical, Ancient, and Scrip-
ture Geography. With Index. 4to or 8vo, Cloth, 10s. 6d.

" In comprehensiveness, accuracy, finished execution, judicious adaptation to educational
purposes, and moderateness of price, this Atlas stands quite alone."—*Athenæum.*

" This is, without exception, one of the best Atlases we ever saw. We commend this Atlas
strongly."—*English Journal of Education.*

V.

School Atlas for Beginners. New Edition. A
Series of Twenty-Seven Maps of the Principal Countries in the World. Oblong
12mo or 18mo, 2s. 6d.

" Deserves a wide circulation. The Maps by Mr. Bartholomew are admirably executed.
Compared with other Atlases of the same size and price which we have seen, this has
decidedly the advantage."—*Athenæum.*

VI.

Atlas of Australia; with all the Gold Regions.
A Series of Maps from the latest and best authorities. *Contents:*—I. General
Map of Australasia, New Zealand, Polynesia, and Surrounding Islands. II.
Australia—Divided into Districts. III. New South Wales, Victoria, and South
Australia, showing the different Gold Deposits. IV. New South Wales— Divided
into Counties, with all the Gold Deposits accurately laid down, and a plan of
Sydney. V. Victoria—Divided into Counties, with all the Gold Districts accu-
rately laid down, and a plan of the Mount Alexander Gold Region. VI. New
Zealand, Van Diemen's Land, and the settled portion of Western Australia,
comprehending Swan River and Australind. Quarto, cloth, 6s.

BLACK'S GUIDE BOOKS FOR ENGLAND, SCOTLAND, AND IRELAND.

Illustrated by Maps, Charts, numerous Views of the Scenery, full particulars regarding Hotels, Inns, Rates of Charges, Distances, and every Information likely to prove Useful or Instructive.

IN PORTABLE VOLUMES STRONGLY BOUND IN CLOTH.

" We have looked carefully through the volumes. They are admirably 'got up ;' the descriptions are accurate, and remarkably clear and comprehensive. We have seldom examined books better 'edited.' . . . . Altogether, this series of works is of immense value to Tourists."—ART JOURNAL.

" They should find a corner in the portmanteau of every person about to undertake a journey of pleasure or business either in England and Wales, or Scotland."—JOHN BULL.

England, Fourth Edition, Corrected throughout, and greatly Enlarged, containing 198 Routes, and Illustrated by Twenty-seven elaborately constructed Maps and Charts, besides Views of the Scenery; an Alphabetical List of Places; Exhibitions, etc., in London, with the Mode of obtaining Admission; all the Hotels and Inns, Rates of Charges, and a Comprehensive General Index. Price 10s. 6d.

Scotland, Twelfth Edition, Greatly Improved, and Illustrated by One hundred and thirty-six Engravings, consisting of an Accurate Travelling Map, Engraved Maps and Charts of Roads, Railroads, and interesting Localities, Plans of the towns of Edinburgh, Glasgow, Perth, and Aberdeen, Views of the Scenery, after Montague Stanley, Cattermole, Leitch, Thomson, J. M. Richardson junior, Sir Thomas Dick Lauder, etc.; and containing full information regarding the best Hotels, Rates of Charges, Coach and Steamer Routes, Distances, and other matters affecting the Convenience of the Tourist. Price 8s. 6d.

Highlands and Islands of Scotland, including ORKNEY and ZETLAND. Descriptive of their Scenery, Statistics, Antiquities, and Natural History. Containing, also, Directions for visiting the Lowlands of Scotland, with Maps, Views, Tables of Distances, Notices of Inns, etc. etc. By George and Peter Anderson of Inverness. Third Edition, carefully Revised, Enlarged, and Remodelled. Price 10s. 6d.

Ireland, Second Edition, embracing Descriptions of all the Routes frequented by Tourists, with full Information regarding Hotels, Inns (and the charges made by each), Conveyances, Guides, and every Topographical Information likely to prove useful. Illustrated by a Map of Ireland, Chart of the Lakes of Killarney on a large scale, and Plans of the principal towns. In a neat pocket volume, bound in cloth limp. Price 5s.

English Lakes, Seventh Edition, Enlarged and Improved. Including an Essay on the Geology of the District, by John Philips, M.A., F.R.S., F.G.S., Deputy Reader in Geology in the University of Oxford; and Memoranda for Botanists. With a minutely accurate Map, by W. Hughes; Charts of the Lakes, Twelve Outline Views of Mountain Groups by Mr. Flintoft, and Views of the Scenery on Wood and Steel. Containing, also, an ample Itinerary of all the Routes, with the Distances accurately laid down, all the best Hotels and Inns, and a Complete Index. Price 5s.

BLACK'S GUIDE BOOKS—*Continued.*

Wales—North and South, and Monmouthshire.
Sixth Edition. Containing a full description of Every Remarkable Place, with Thirty-five Illustrations, including Maps, Charts, and Views of Scenery; with all the Hotels and Inns, and a Copious Itinerary. Price 5s.

Edinburgh, with a Description of the Environs.
New Edition. Illustrated with a Plan of the City, a Map of the Country Ten Miles round, and numerous Views of the Public Buildings and Scenery. Price 2s. 6d., or without Illustrations, 1s. 6d.

Glasgow and the West Coast. Including the Falls
of the Clyde, Bute, Arran, Staffa, Iona, and the Land of Burns; with a Plan of Glasgow and other Charts, numerous Views of the Public Buildings and neighbouring Scenery. Price 2s. 6d., or without Illustrations, 1s. 6d.

Derbyshire, including Matlock Bath, Chatsworth,
Buxton, Castleton, Dovedale, and every other place of interest. Second Edition. With a Map of the County and Plan of Chatsworth. Price 1s. 6d.

Hampshire and Dorsetshire, including descriptions
of the Isle of Wight, Winchester, Southampton, Netley Abbey, Portsmouth, the New Forest, Weymouth, Dorchester, Poole, and every other place of interest. With Map. Price 1s. 6d.

Devonshire and Cornwall, Exeter, Plymouth and
DEVONPORT, LAUNCESTON, TRURO, LANDS-END AND THE SCILLY ISLANDS. With Map. Price 1s. 6d.

Warwickshire, with Map of the County and
numerous Illustrations. Price 1s. 6d.

The Trosachs, Loch Katrine, Loch Lomond, and
Neighbouring Routes, including the Districts of Aberfoyle, Balquhidder, Menteith, and Rob Roy's Country, etc. etc.; with Map and numerous Illustrations. Price 1s. 6d.

Perthshire, including Descriptions of Perth and
Environs—Dunkeld, Blair-Atholl, Kenmore, Loch Tay, Killin, Lochearnhead, Callander and the Trosachs; with Map, Charts, and numerous Illustrations. Price 1s. 6d.

Argyleshire, containing a Description of Glasgow,
Gareloch, Loch Long, Loch Goil, Bute and Arran, and all the principal places of interest and resort on the West Coast of Scotland, the various Steamer and Coach Routes, etc.; with Map. Price 1s. 6d.

Staffa, Iona, Glencoe, and Caledonian Canal,
including a description of Oban and its Vicinity; with Map of Mull, and a view of Fingal's Cave. Price 1s. 6d.

Island of Skye, and West of Ross-shire; with a
Map of Skye. Price 1s. 6d.

Aberdeen, Balmoral, and Braemar, including Ex-
cursions among the Cairngorm Mountains; with Map and Illustrations. Price 1s. 6d.

Moffat and Vicinity, St. Mary's Loch, the Grey
MARE'S TAIL, LOCH SKENE, etc., and Hints to Anglers in the Rivers, Streams, and Lochs in the Neighbourhood; with Map and Illustrations. Price 1s. 6d.

MEDICAL AND SURGICAL WORKS.

I.

Addresses to Medical Students : Delivered at the instance of the Edinburgh Medical Missionary Society, 1855-56. By W. P. ALISON, M.D., Emeritus Professor of the Practice of Physic in the University of Edinburgh; GEORGE WILSON, M.D., Professor of Technology in the University of Edinburgh; ANDREW WOOD, M.D., President of the Royal College of Surgeons of Edinburgh; BENJAMIN BELL, F.R.C.S.E.; and JOHN COLDSTREAM, M.D. Fcap. 8vo. 3s. 6d.

II.

By Sir GEORGE BALLINGALL,
Late Professor of Military Surgery in the University of Edinburgh,

Outlines of Military Surgery. Fifth Edition, illustrated. 8vo. 16s.

III.

By JOHN HUGHES BENNETT, M.D., F.R.S.E.,
Professor of the Institutes of Medicine, and of Clinical Medicine,
in the University of Edinburgh,

An Introduction to Clinical Medicine. Six Lectures on the Method of Examining Patients, and the Means necessary for arriving at an Exact Diagnosis. Third Edition, with numerous illustrations. 12mo. 5s.

IV.

By the same Author,

Clinical Lectures on the Principles and Practice of Medicine. Demy 8vo. Illustrated.

V.

By ROBERT CHRISTISON, M.D.,
Professor of Materia Medica in the University of Edinburgh,

A Treatise on Poisons. In relation to Medical Jurisprudence, Physiology, and the Practice of Physic. Fourth Edition, enlarged and improved. 8vo. 10s.

VI.

By WILLIAM GREGORY,
Professor of Chemistry in the University of Edinburgh,

Elementary Treatise on Chemistry. Illustrated. Fcap. 8vo. 5s.

MEDICAL AND SURGICAL WORKS—*Continued.*

VII.

By THOMAS LAYCOCK, M.D., F.R.S.E., F.R.C.P.,
Professor of the Practice of Medicine, and of Clinical Medicine, in the
University of Edinburgh, &c. &c.,

Medical Observation and Research.

VIII.

By JAMES MILLER, F.R.S.E.,
Professor of Surgery in the University of Edinburgh, &c. &c.

The Principles of Surgery. Third Edition, illustrated by 240 Wood Engravings. 16s. cloth.

IX.

By the same Author,

The Practice of Surgery. New Edition, illustrated by 227 Wood Engravings. 16s. cloth.

X.

By ALEXANDER MACAULAY, M.D.,

A Dictionary of Medicine, designed for Popular

Use. Containing an Account of Diseases and their Treatment, including those
more frequent in Warm Climates, with directions for administering the various
substances used as Medicines, the Regulation of Regimen and Diet, and the
management of the Diseases of Women and Children. Thirteenth Edition.
8vo. 12s.

XI.

By JAMES Y. SIMPSON, M.D., F.R.S.E.,
Professor of Medicine and Midwifery in the University of Edinburgh,

Obstetric Memoirs and Contributions, including

those on Anæsthesia. Edited by W. C. PRIESTLEY, M.D., and H. R. STORER,
M.D. 2 vols. 8vo. Profusely Illustrated. 36s.

XII.

By T. S. TRAILL, M.D.,
Professor of Medical Jurisprudence in the University of Edinburgh,

Medical Jurisprudence, being Outlines of a Course

of Lectures. Third Edition. Fcap. 8vo. 6s.

XIII.

By CHARLES WILSON, M.D.,

The Pathology of Drunkenness. A View of the

Operation of Ardent Spirits in the Production of Disease, founded on Original
Observation and Research. Fcap. 8vo. 3s.

EDUCATIONAL WORKS.

Class-Book of English Poetry. Comprising Ex-
tracts from the most distinguished Poets of the Country. By DANIEL SCRYM-
GEOUR. Fifth Edition. 12mo, price 4s. 6d. Also to be had in Two Parts at
2s. 6d. each. Part I.—Containing the Poets from Chaucer to Otway. Part II.—
From Prior to Tennyson.

Elementary Grammar of the Greek Language.
By Dr. L. SCHMITZ, Rector of the High School of Edinburgh. 12mo, price
3s. 6d.

First Steps in the Physical and Classical Geo-
graphy of the Ancient World. By JAMES PILLANS, Professor of Humanity in the
University of Edinburgh. Third Edition. 12mo, price 1s. 6d.

Collection for Schools, from the Works of Sir
WALTER SCOTT. Seventh Edition. Roan, price 3s. 6d.

"An invaluable book, exciting in the young a desire to read."—*Glasgow
Herald.*

Scotland.—By Sir WALTER SCOTT, Bart. From
the Earliest Period to the Close of the Rebellion, 1745-46. Twentieth Edition.
2 vols., bound, price 10s.

Scotland.—By P. F. TYTLER, Esq. Enlarged and
Continued to the Present Time, by the Rev. JAMES TAYLOR, D.D., and adapted
to the Purposes of Tuition by ALEX. REID, LL.D. Sixth Edition. 12mo, price
3s. 6d.

France.—By Sir WALTER SCOTT, Bart. New Edi-
tion. Illustrated. Fcap. 8vo, price 4s.

Palestine.—By JOHN KITTO, D.D. From the
Patriarchal Age to the Present Time; containing Introductory Chapters on the
Geography and Natural History of the Country, and on the Customs and Insti-
tutions of the Hebrews. Adapted to the purposes of Tuition, by ALEX. REID,
LL.D. 12mo, price 3s. 6d.; or with Map of Palestine, 4s.

Modern History.—By A. F. TYTLER, late Professor
of Universal History in the University of Edinburgh. Fourth Edition. 12mo,
price 3s.

By the same Author,

Ancient History.—Fourth Edition. 12mo, price 3s.

MISCELLANEOUS WORKS.

CAIRD.—*The Poor Law Manual for Scotland.*
By ALEXANDER M'NEEL CAIRD, Esq. Sixth Edition. Crown 8vo, 7s. 6d.

COCKBURN.—*Memorials of his Time.* By HENRY
COCKBURN, late one of the Senators of the College of Justice. With Portrait
after Raeburn. Demy 8vo, 14s.

"This posthumous volume requires no introduction to the public at our
hands. Valuable as a contribution to the history of one part of the kingdom
during a portion of the last and of the present century, sketched by a contempo-
raneous pen of great acuteness, felicity, and humour, it has also taken its place
as one of the pleasantest fireside volumes which has been published of late years."
—*Edinburgh Review.*

By the same Author,

Life of Lord Jeffrey, late one of the Senators of
the College of Justice. Second Edition. 2 vols. 8vo, 25s.

CREUZE.—*A Treatise on the Theory and Practice*
of Naval Architecture. By AUGUSTINE F. B. CREUZE. 4to, 12s.

DENISON.—*Clocks and Locks.* From the Eighth
Edition of the "Encyclopædia Britannica." Second Edition, with a full account
of the Great Clock at Westminster. By EDMUND BECKETT DENISON, M.A., Q.C.
Illustrated. 12mo, 8s. 6d.

"We refer such of our readers as take an interest in the science of lock-
picking, to Mr. Denison's very amusing volume. There they will find all the
recent attempted improvements both in locks, clocks, and watches, fully described,
and their merits and defects criticised in a most workmanlike style."—*Scotsman.*

"*Useful from the amount of information it communicates on the subject* of clocks
and locks, and amusing from the personal details which the author gives us."—
Practical Mechanic's Journal.

Edinburgh Essays. By MEMBERS of the UNIVER-
SITY. Contents:—I. PLATO. By JOHN STUART BLACKIE, M.A., Professor of
Greek in the University. II. EARLY ENGLISH LIFE IN THE DRAMA. By JOHN
SKELTON, Advocate. III. HOMŒOPATHY. By WILLIAM T. GAIRDNER, M.D.,
etc. IV. INFANTI PERDUTI. By ANDREW WILSON. V. PROGRESS OF
BRITAIN IN THE MECHANICAL ARTS. By JAMES SIME, M.A. VI. SCOTTISH
BALLADS. By ALEXANDER SMITH, Secretary to the University. VII. Sir
WILLIAM HAMILTON. By THOMAS SPENCER BAYNES, LL.B. VIII. CHEMICAL
FINAL CAUSES. By GEORGE WILSON, M.D., F.R.S.E., Regius Professor of
Technology in the University. Demy 8vo, 7s. 6d.

FALCONER.—*The Shipwreck.* By WILLIAM FAL-
CONER, with Life by ROBERT CARRUTHERS, and Numerous Exquisite Illustra-
trations by Birket Foster and Noel Humphreys. In small 4to, elegantly bound
in cloth, gilt, price 12s. 6d.; morocco extra, 21s.

FORBES.—*A Review of the Progress of Mathematical and Physical Science* in more recent times, and particularly between the years 1775 and 1850; being one of the Dissertations prefixed to the Eighth Edition of the "Encyclopædia Britannica." By JAMES D. FORBES, D.C.L., F.R.S., Professor of Natural Philosophy in the University of Edinburgh. 4to, 8s. 6d.

By the same Author,

Norway and its Glaciers. Followed by Journals of Excursions in the High Alps of Dauphiné, Berne, and Savoy. By JAMES D. FORBES, D.C.L., F.R.S., Sec. R.S., Edin.; Corresponding Member of the Institute of France, and Professor of Natural Philosopy in the University of Edinburgh. With Two Maps, Ten Lithographic Views printed in colours by Day and Son, and Twenty-two Wood Engravings. Royal 8vo, 21s.

" This is one of those books which we need not blush to present to foreign philosophers and men of learning as a specimen of the literature of science in England."—*Examiner*.

By the same Author,

The Tour of Mont Blanc and of Monte Rosa. Being a Personal Narrative, abridged from the Author's " Travels in the Alps of Savoy," &c. Illustrated, 12mo, 5s.

" An admirable edition, and the Map of the Mer de Glace most correct and valuable."—*Albert Smith.*

FRASER.—*Turkey Ancient and Modern.* Being an Historical Survey of the Ottoman Empire, from its establishment in Europe to the Present Day. By ROBERT W. FRASER, M.A. Crown 8vo, 7s. 6d.

GRAHAM.—*Musical Composition:* Its Theory and Practice With numerous Engravings and copious Musical Illustrations interspersed with the text. By G. F. GRAHAM, Author of the article Music in the "Encyclopædia Britannica." 4to, 9s.

JOHNSON.—*Madeira, its Climate and Scenery:* a Hand-Book for Invalid and other Visitors. By ROBERT WHITE. Second Edition. Edited by JAMES YATE JOHNSON, of the Middle Temple. With Map, Crown 8vo, 7s. 6d.

JUKES.—*The Student's Manual of Geology.* By J. B. JUKES, M.A., F.R.S., Local Director of the Geological Survey of Ireland, and Lecturer on Geology to the Museum of Irish Industry. Crown 8vo, 8s. 6d.

MACAULAY.—*A New Edition (the 14th) of Macaulay's Medical Dictionary,* designed for Popular Use; containing an Account of Diseases and their Treatment, including those most frequent in Warm Climates. Greatly enlarged and improved, and in most part re-written, by ROBERT WELBANK MACAULAY, M.D., H.E.I.C.S. Demy 8vo, 10s. 6d.

M'CULLOCH.—*A Treatise on Metallic and Paper Money and Banks,* written for the Encyclopædia Britannica. By J. R. M'CULLOCH, Esq., 4to, 5s.

" By modern students it will be found most concise and valuable, since it brings the entire subject to its latest stage, and is characterised by all the vigour and clearness of expression peculiar to the author of the Commercial Dictionary."—*The Times.*

By the same Author.

Treatises on Subjects Connected with Economical Policy; with Biographical Sketches of Quesnay, Smith, and Ricardo. 8vo, 14s.

NICOL. — *Elements of Mineralogy;* containing a General Introduction to the Science, with descriptions of the Species. By JAMES NICOL, F.G.S., Professor of Natural History in Marischal College and University of Aberdeen. 12mo, 5s.

POOLE.— *The Genesis of the Earth and of Man :*
A Critical Examination of Passages in the Hebrew and Greek Scriptures ; chiefly
with a View to the Solution of the Question—Whether the Varieties of the
Human Species be of more than One Origin. Edited by REGINALD STUART
POOLE, M.R.S.L., &c. Crown 8vo, 5s.

RAMSAY. — *The Gentle Shepherd.* By ALLAN
RAMSAY. New Edition, with numerous Illustrations after David Allan.
18mo, 2s. 6d.

RUSSELL.— *The Steam-Engine.* By JOHN SCOTT
RUSSELL, M.A., F.R.S.E. Illustrated. Post 8vo, 5s.

By the same Author,

Steam and Steam Navigation. A Treatise
on Nature, Properties, and Applications of Steam and on Steam Navigation.
Illustrated. Post 8vo, 9s.

RUSSELL.—*North America;* its Agriculture and
Climate: containing observations on the Agriculture and Climate of Canada, the
United States, and the Island of Cuba. By ROBERT RUSSELL, Kilwhiss. With
Coloured Map and Plans. Demy 8vo, 14s.

SCRYMGEOUR.— *The Poetry and Poets of Britain.*
From Chaucer to Tennyson, with Biographical Sketches, and a rapid View of the
Characteristic Attributes of each. Preceded by an Introductory Essay on the
Origin and Progress of English Poetical Literature. By DANIEL SCRYMGEOUR.
Post 8vo, 6s. cloth ; 6s. 6d. cloth, gilt edges.

SMITH.— *The Wealth of Nations.* An Inquiry into
the Nature and Causes of the Wealth of Nations. By ADAM SMITH, LL.D.
Edited, and with Life of the Author, by J. R. M'CULLOCH, Esq. Fourth Edition,
corrected throughout, and greatly enlarged. 8vo, 16s.

SPALDING.—*An Introduction to Logical Science.*
By WILLIAM SPALDING, A.M., Professor of Logic in the University of St. Andrews.
12mo, 4s. 6d.

"Professor Spalding publishes in a separate form his elaborate and first-rate
article on Logic from the Encyclopædia Britannica. We highly recommend this
treatise to the more advanced student."— *Westminster Review.*

STEWART.— *The Practical Angler ;* or the Art of
Trout Fishing, more particularly applied to Clear Water. By W. C. STEWART.
Third Edition. 12mo, 3s. 6d.

"Without hesitation we pronounce this little treatise the best we have ever
read on angling for trout with the artificial fly, worm, minnow, and other bait."—
Bell's Life in London.

YOUNG.— *The Angler and Tourist's Guide* to the
Rivers, Lakes, and Remarkable Places in the Northern Counties of Scotland. To
which is added instructions to young Anglers. By ANDREW YOUNG, Invershin,
Sutherlandshire. 18mo, 2s.

MAPS.

I.

NEW MAP OF EUROPE.

Size 3 by 4 feet 4 inches. Scale, 80 miles to the inch.

Engraved from the most recent authorities, and coloured with the greatest precision and accuracy. Accompanied by a Map of the Telegraphic Lines and Fortresses of Europe, &c. &c. Price 16s. in sheets, or 18s. Mounted on Linen, in a handsome Portable Case, and 25s. on Mahogany Rollers Varnished.

"Admirably executed, and along with it a valuable compendium of the geography of Europe in letterpress."—*John Bull.*

II.

LARGE MAP OF AUSTRALIA, TASMANIA, AND NEW ZEALAND.

Size 48½ by 39½ inches.

Taken from the British and French Government Surveys and other sources of recent and authentic information. Containing also, on an enlarged scale, the Colony of Victoria, Port Jackson, and Botany Bay, with the Environs of Sydney; Mount Alexander Gold Region; Tasmania or Van Diemen's Land, with the Electoral and Police Divisions; Port Philip, with Melbourne; Map of Norfolk Island, and a Sketch Map, showing the principal Commercial Routes to Australia, &c. &c. Price 21s. in sheets, and bound in Cloth, 8vo or 4to, or on rollers varnished, 31s. 6d.